QUOD DEUS VULT FIET

Pettus

1686

21773/D

ERCKER, Lazarus



S^r. John Pettus of Suffolk Kn^t. 1641
One of the Dep.^ty Governors of y^e Mines Royall.
1651. Auratus Infletatus. 1679.

62203

FLETA MINOR.

THE

LAVVS

OF

ART and NATURE,

IN

Knowing, Judging, Aſſaying, Fining, Refining and Inlarging the BODIES of confin'd

METALS.

In Two Parts.

The *Firſt* contains *ASSAYS* of *Lazarus Erckern*, Chief *Prover* (or *Aſſay-Maſter General* of the Empire of *Germany*) in V. BOOKS: originally written by him in the *Teutonick* Language, and now tranſlated into *Engliſh*.

The *Second* contains *ESSAYS* on *Metallick Words*, as a DICTIONARY to many pleaſing DISCOURSES.

By Sir *John Pettus*, of *Suffolk*, K^t. Of the *Society* for the *MINES ROYAL*.

Illuſtrated with 44 *Sculptures*.

Mal. 3. 3. *Numb.* 31. 31.
Jehovah Chimiſta Supremus.
Carolus D. G. Secundus.

LONDON,
Printed for and ſold by *Stephen Bateman* at the Sign of the Bible over againſt *Furnivals*-Inn Gate in *Holbourn*. MDCLXXXVI.

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TO THE

Kings most Excellent MAJESTY.

SIR,

THE Materials of this Book are derived from your Majesties undoubted *Prerogative* to the *Mines* (in your Dominions,) of which *Metals* are made; Of them *Moneys:* And then honoured with your Majesties *Superscription.* And so by a *Christian Circulation,* the Possessors do, or ought to render to *Cæsar* the things which are *Cæsar's.*

Thus Your Majesty hath a double Right to the *Mines*, and to the Products of the *Chimical Art*, by which *Metals* are fitted for their Journey to *Publick Commerce.*

Herein I humbly offer my *Endeavours* to assist their motions, and onely to refresh your Majesties *Memory*, not to inform Your *Knowledg:* for (as 'tis hinted in the Title Page) Your Majesty is (in the *Science* of *Chimistry*, as in all *Sciences of Humanity) Nulli Secundus.*

These *Perfections* are evident in Your Majesties publick and private *Elaboratories*, from which pure *Justice*, and pleasing *Arts* and *Sciences* are communicated to Your *Subjects.*

In

In these I have observed Your Majesties particular respects to *Chimistry* (of an *Universal Extent*,) and thereupon I resolved to transplant this *German Twig* of *L. Erckern* (on that Subject) into Your Majesties Nursery; and Humbly Dedicate it to Your Majesty, (with my Additionals)and also Humbly crave your *Acceptance*, as an *encouragement* to my *further Progress* in serving Your Majesty with more Fruits; but at present it is to shew, That I am intent in promoting the *Services* I owe Your Majesty, as well with my sedentary *Passive Pen*, as before with my *personal Active Duty*, having (upon some significant occasions) had the Honour to be known to Your Majesty near Forty Years.

Now, Great Sir, Wherein I am incapacitated to express my *Duty*, for want of *Ability* of *Mind* or *Body*, or *secular Fortunes*; they shall be supplied by my *constant Prayers* for Your Majesties Health, Happiness, and Serenity in Your Government, being

Your Majesties most Obedient

Feb. 26. 8$\frac{2}{3}$.

and Humble Subject,

JOHN PETTUS.

To the Right Honourable, *George Marquess*, Earl, Viscount *Hallifax*, and Baron of *Eland*, Lord Privy Seal, and one of His Majesties most Honourable Privy Councel; and Governour of the Society of the *Mines Royal*, and *Battery Works*.

My Lord,

Your Lordships free acceptance of the Government of the Mines Royal, *hath encouraged me to add it to your* Titles, *and I hope without the least* disparagement *to your other* Honours, *deservedly conferred upon your* Lordship *by His Majesty.*

It is a Trust *of* great Concern *(and I doubt not but it will be so managed by your Lordship) and of* Honour *too, (as it hath been always esteemed) for (not to trouble your Lordship with very* Antient Records,*) I find that King* Edward *the Fourth did make* Richard *Earl of* Warwick *(who soon after was made one of the* Governors *of this* Kingdom, *during its Troubles) and* John *Earl of* Northumberland, *his* Guardians *and* Governors *jointly of all his* Mines *in* England; *and King* Henry *the Seventh made* Jasper *Duke of* Bedford, *and other Earls and Lords, his* Guardians *also of all the* Mines *in* England *(adding* Wales.*) And Queen* Elisabeth, *in the* 10*th. of her Reign, did form the Government thereof into Societies, by the Names of* Governors, Deputy-Governors, *and* Assistants *for the* Mines Royal *and* Battery-Works, *and then made Sir* Nicholas Bacon, Lord Keeper, *and other eminent persons, her* Governors *for* England *and* Wales, *(adding those within the* English Pale *in* Ireland,*) which Government did continue Successively to the Earl of* Pembrook, *and others for some Years:*

B *and*

and after, his late Highneſs Prince Rupert *was made a Governour; and your Lordſhip to our contentment, doth ſucceed him.*

Now, my Lord, *As for my ſelf, I have been one of the* Deputy Governors *for above 30 Years, and do think my ſelf obliged in point of Gratitude to the late Governours, and preſent Members (who were pleaſed unanimouſly to order a* Contribution *to the Charge of this* Book, *and for ſome former Favours,) to endeavour the advancing of their Concerns (eſpecially now we have the Honour to be under your* Lordſhips *Regiment,) and therefore as an* Introduction *to my real Intents, I not only publiſh this, but by ſome Additionals, I ſhall ſtudy to make the* Government *more advantagious to the* Society, *and much more to His Majeſty; and even to other Proprietors of* Mines, *wherein I have ſat ſtill ſome Years, becauſe I found that I ſhould be obſtructed by ſome who ſtudied the advance of themſelves more than His* Majeſties *Revenues, which I do not aim to do by any Oppreſſing* Method, *or projecting Humour (for I hate it) but by an honeſt juſt way, and I hope not diſpleaſing to any, but ſuch as nothing will pleaſe.*

And theſe I ſhall in due time communicate to your Lordſhip, *being ſo confident of your* Lordſhips *great* Abilities, *(join'd with your perfect* Loyalty *to your* King, *and* Love *to your* Country) *that your* Lordſhip *will not approve of any thing that I ſhall offer, if it agrees not with your* Lordſhips *ſound Judgment and deep Wiſdom, for which all who knows your Lordſhip have an high value, and particularly*

Your Lordſhips moſt humble

and obliged Servant,

JOHN PETTUS.

To the Noble and Honoured Subſcribers and Contributers to this BOOK.

My Lords and Gentlemen,

I Did deſign to have publiſh't your Names in a way that ſhould have more fully manifeſted your *Favours*, and my *Acknowledgments*; but this *Book* extending to above 50 ſheets more than I deſign'd, or at firſt propoſed, took up my limited time, ſo as I muſt reſpit that intention, for I have not done with this *Subject*; intending not to trouble you or my ſelf with Subſcriptions, but ſuch as have Subſcribed to this, ſhall have notice when the next is ready; and if they approve of *this* ſo well as to take the *next* from me, it will be an additional Obligation to me, for I am prepared to go through the Body of this Art, upon theſe *Reaſons*; Firſt, *That it contains the Grounds and Maxims of moſt admirable Speculations*; and next, *That I may divulge their chiefeſt and moſt curious Experiments and Practicks*: Now, that which incited me to this, was occaſioned from hence, That having cauſed *Erckern*'s Books to be Tranſlated about Ten years ſince; ſome eminent perſons did perſwade me (like the Story in *Bocalino*,) not to publiſh it, leſt the Common ſort of People ſhould make an ill uſe of its impartments, alledging, That it was not well Tranſlated: whereupon I betook my ſelf to the *German* Language, and in a ſhort time I was ſo much Maſter of it, That with the help of a *German* here, I did indeed find many Errors, and Corrected them, which anſwers one Objection; and I have Printed ſuch a convenient Number as may anſwer the other; And yet I am not altogether ſatisfied therein; for, what hath made *Arts* and

Sciences

Sciences flouriſh more in the time of King *Charles* the Firſt, and now in His Majeſties Reign, than their Majeſties encouragements to the free communication of ſuch things as had many Ages before lain ſecret? ſo that we hope that all *Pancerollus* his loſt things may in a ſhort time be found again.

We puniſh our ſelves by fixing and diſputing on the *Theorems* of antient *Writers*, and thereby making things to be *Diabolical*, which are only *Divine Favours* ſhewn us by *Natural Agents*, ſo as for want of knowing the true *Practicks* & *Experiments*, they are divulged either by umbraging *Sophiſtications*, or concealed under the Name of *Philoſophical Secrets*, which, no doubt, but *GOD* intends for a publick and common *Good*: and this ill Fortune befell the *Unguentum Armarium*, as a piece of *Witchcraft*, 'till our *Eyes* were *inlightned*; and in many other things (which were they clearly commmunicated) ſuch *Superſtructures* would be raiſed from them, as might arive us to a kind of *Angelical Knowledg* in this World, and make us more apprehenſive of our *Happineſs* in the next: and therefore it ſhall be my ſtudy to unfold the *Metaphyſical Notions* of this *SCIENCE*: by Practicks eſpecially about the *Philoſophers Stone*, which *Study* I value only for its fine *Purſuits* and *Products* of *Experiments*, but more, becauſe the *Laborers* for it are, by their own Affirmations, obliged to a *ſtrict* and *religious* Life:

I ſhall trouble you no further at this time, but with my humble and hearty Thanks: and ſo ſubſcribe my ſelf

My Lords *and* Gentlemen

Your moſt humble Servant

JOHN PETTUS

To my Worthy Friend, Richard Manlove, Esq; *Warden of the* Fleet.

SIR,

I Am here, a confined Person, for my being too kind to others, and too unjust to my self, and for not doing what was not in my Power to perform, by wanting the Justice of my *Debtors*, whereby I am rather a Prisoner to them than to my *Creditors*.

Yet I can dispense with all these, because they have occasioned my happiness, in your Acquaintance,and my contenting Retirement in this place, which was once a *Palace*, after, a *Staple* of Comerce, and long since and still, a *Repository* of our *Laws* : And now, like *Homers* Iliads in a *Nut-shell*, here are all sorts of Degrees, from *Prince* to *Peasant*, all sorts of *Professions*, from the *Doctor* to the *Novice*; all sorts of Trades and Manufactures, and all sorts of *Virtues*; but your *Prudence* doth still suppress the *Vices*.

And I ingeniously confess,that by yours,& your Ladies constant *Kindness* & *Indulgence* to my declining years, I have made it a *Colledge* of *Learning*, and so may other Gentlemen do (if they please) it being so qualified,that in an hours time there is no *Art* or *Science* wherein one may not be punctually instructed.

Now, Those that think themselves Prisoners to you are much mistaken, for they are Prisoners to the *LAWS*, and may make themseves *Students* of *All-souls* in *Le Fleet*, of which you are *Warden*.

A Guardian-ship very needful for the People, as a Completion of *JUSTICE*, in point of Restraints: For, (besides many other wise Considerations) they are good for Cooling the *Animosities* between *Creditors* and *Debtors*, and between the *LAWS* and *Contemners* of them, (and thereby prevents the *Effusion* of *Blood*, which hath often hapned) and for Curing the *sullen* and *contemptuous* Dispositi-on of others to their Superiours.

For, I can truly ſay, That, by my patient Submiſſion to them and my Misfortunes (being prepared with my 14 months Impriſonment in *Windſor* Caſtle, under the late *uſurped* Power) I do now with more Satisfaction to my ſelf, undergo this under a *Legal* Power, and thereby I affirm, That no Gentleman hath receiv'd greater *Reſpects* from you than my ſelf, and therefore I take this Occaſion to make my publick *Acknowledgments*, that it may be a *Guid* to other mens *Contentments*, for, as I have obſerv'd, That as you never were out-*Hector'd* by *Affronts* or *Reſiſtances*, ſo you were never *out-done* by *Civilities* or *Compliableneſs* to your *Methods*.

As to the *firſt*, I never gave Occaſion; and as to the other, my ſtudious *temper* complying with your *Love* to *Learning* have ſo won on your good Diſpoſition, that I muſt acknowledg to my honored *Subſcribers*, and others, that had it not been for your *Incouragement* and particular *Aſſiſtance* with your purſe; (though with ſome *Inconveniencies* to your own Occaſions) I could not have finiſhed this *Book*, as now I have done, and therefore as one *Memorial* of your kindneſs, I have given it the name of *FLETA*, and in my Picture minted the word *infletatus* from this Place.

I could with delight to my ſelf and others, ſpend more time on this *Subject*; but I muſt end with this *requeſt*, That as you have given Houſe-room here to the *whole Impreſſion* of my *Books*, ſo you will pleaſe (in reſpect my perſon is reſtrain'd in *Execution* of the *Laws*,) to encourage it in its *Travels* abroad; and ſo not doubting of your *Favour*, I ſhall conclude with *Ovid*, (then, in my *preſent Condition*, but I will not puniſh my ſelf with his *Triſtibus*'s,)

Parve nec invideo ſine me Liber ibis in { *Aulam* / *Urbem* }

Which I have thus Engliſht,

Go little Book, leave me, but make report,
Who treats thee beſt, the City or the Court.

However you ſhall have the continuing thanks of

Your Obliged Friend and Servant
JOHN PETTUS.

To the Courteous READER.

I Think fit before you read this Book, to instruct you in the Method of it, so as you may read the whole, or part, as your leisure serves.

1. It is divided into two parts (as the Title mentions,) viz. Erckern's V. Books, and my Dictionary.

2. Whereas the Original of Erckern's 5 Books had no Numeral distinction of Chapters and Sections, I have divided them into Chapters and Sections, and Printed them before the Five Books, with numeral referrences to their chapters where they are contain'd.

3. Whereas the Sculptures had only Literal, and no Numeral Directions of their Contents, I have in the second part of the Contents before the Five Books, Printed the Contents of the Sculptures, with references to the Pages where they may be seen and read.

4. Whereas the Original of Erckern's 5 Books hath no Coma's, Colons, Periods, Parenthesis, or Interrogatory Points, pertinent to the distinction of Words or Sentences (which are also wanting in many German Books) I have comply'd them to our way of Orthography, (which was no little trouble,) and therefore if the Reader find some few Omissions, they may upon that account be the more kindly dispens't with.

5. I do retain many antient and Saxon Words, upon the account of their affinity to the like Words which are still used among us, and these are hinted in the Dictionary.

6. In the Dictionary or second part, the first Words which I thought fit to explain, are in Capital Letters, and next, the Teutonick and Latine Words for those Capitals; (and other Languages,

Languages, as occasion requires,) and these I collected from G. Agricola, Alstidius, Cowel, Minshaw, *and* Skinners *Dictionarys for the* Teutonick, *from* Cooper *and* Holiock *for the* Latine; *from* Florio *for the* Italian, *from* Cotgrave *for the* French; *and from* Waltons Lexicon *for the* Oriental Tongues, *which, with a* German *was all the help I had for the use of above* 600 *Words; but the two chief Languages, of which I make the greatest use, are the* Teutonick *and* Latine, *this from the old* Romans, *(who continued amongus above* 500 *years) the other from the* Saxons *(who were mixt with us as long,) from both of which* Nations *we gain'd a particular knowledg of* Mines *and* Metals, *as may be evident from many* Roman *and* Saxon Works, *which remain here under their* Names *to this day; and many of our Monarchs, particularly Queen* Elizabeth *did think fit to desire the assisting* SKILL *of the* Germans, *to improve* OURS; *to prevent which trouble, I here publish part of their* Art, *and intend more.*

Lastly, *I have given it the Title of FLETA, which is borrowed from an eminent* Lawyer, *who whilst he was Prisoner in the FLEET, writ his Learned Book of* the Common Laws of England, *and thereupon (as 'tis said,) he call'd his Book FLETA* (Cowel) *to which I add MINOR, in submission to his great Learning, and for its affinity to the word MINER,* viz. *one who Labours in the* Mines, *as I do in* Learning *the* Metallick Art.

To conclude, I have writ some things from Authentick Authors *(too many to recite here,) and some from my own* Conceptions *and* Observations; *now as they* pleased *me in* writing, *so I hope they will not* displease *others in* reading.

JOHN PETTUS.

THE PREFACE OF Lazarus Erckern, To his five following BOOKS.

*T*O *learn and underſtand the way of* Aſſaying, Proving *and* Refining *of* Metalls, *is an Excellent*, Noble Science, *and an Antient and* profitable Art, *long ſince found out by the Art of* Alchimy *and* Chimiſtry, *as alſo all other Works of the* Fire, *by which not only the nature of* Oars *and* Mines, *and what* Metalls *contained in them are known; but alſo how much there is in a* Centner, *or in greater or leſſer* Weights, *and not only ſo, but this* Art *alſo teacheth how to Examine each* Metal *by it ſelf, as whether there be any* Adulterated *or* mixt Metal *with it;* what, *and* how *much the ſame is, and then which* way *thoſe* Metals *may be* ſeparated *from ſuch mixtures or adulterations, as alſo by ſeveral ways to cleanſe and ſeparate other incorporated* Metals, *ſo that they may be judged to be* fine, clean *and* free *from mixtures, therefore this* Art *is very profitable to* Mineriſts *and ſuch as work in* Mines *and intend to have benefit by them, and ſuch* Artiſts *muſt endeavour* Of the Art of Aſſaying.

A by

by all means to learn and exercise themselves in the same, that they may thereby reap a Profit to themselves and others, and preserve themselves from Inconveniencies *and* Dangers *by their want of knowledge therein.*

By this Art *of* Refining *and the* Profit *that acrews by it, many good and rich* Mines *have been discovered, which otherwise would have lain concealed: and by the Advantage of these* Discoveries *many* Cities *and* Villages *have been built,* Lands *have been improved in their Values,and* People *thereby increased and plentifully maintained: As also great and mighty* Trades *and dealings with* Gold, Silver, Copper *and other*Metals *here, and in other* Countreys *exercised, and the* Coiners *of* Coin *and* MintingWorks *have been multiplyed by their* Guardians *and* Masters ; *for from* Gold *and* Silver, Money *is made and much improved, so that the true* Insight, Tryal *and* Examination *of this* Art, *cannot be in any wise omitted or neglected, as that which is highly necessary to be known.*

Rewarded by Princes. *And such* Artists *as have exercised themselves in the Knowledge of* Assaying, *and fundamentally and diligently practised the same, are by* Princes, Lords *and* Communities *thought worthy not only of great* Thanks, *but been also* promoted *and* recompenced *by them.*

Mother of ARTS. *For this* Art *of* Assaying *is the very* Inlet *and* Mother *of many other* honorable *and* profitable Sciences *as* Experience *teaches us, and the more a man finds out, the more he is stir'd up to the* contemplating *and doing things of an higher Nature.*

To know Metals necessary. *So that the Knowledg of* Metallick Oars *and* Minerals *are first to be inquir'd into,* namely, *How each one according to their* Nature,Figure,Form *and*Colour *are* distinguishable *from each other: Which without great* diligence *and daily* Practice *cannot be known, because* God *the* Almighty Creator,*in the beginning of the* Creation *of the* World

World, *hath plac'd* Metals *and* Minerals *in the* Mountains, Valleys *and* Veins *of the* Earth,*and causeth them to grow there:* He *hath also given to all and each of them an* outward Form *and* Colour *by which the one from the other may be distinctly known.*

Secondly, *The Knowledg of the* Fire *is a principal part of this* Science, *and very necessary to be inquired into, that he may the better know how to* govern *the same, so that he may give no Metal more* Fire *than its due, but to every one its proportion of* Heat *and* Cold, *as necessity requires to add or take from it, in its Operation.* How to use Fire in Metals.

After the Knowledg of Governing *the* Fire, *the* Artists *must have the Knowledg also of making all the* Instruments *and* Furnaces *for this, either by his own handy work, skillfully to prepare them, or at least to direct that they may be well made, whereby he may not be hindred in his working, but by his own diligence accomplish them.* To make Instruments. Furnaces.

In like manner he must be careful in procuring good and just Scales *and* Weights, *and to know also how to make them (in case such* Artificers *should be wanting) and fit them to all* Metals, *and he must have great Care in preserving them from* Dust, *and that they be alwayes pure and clean so that (as occasion serves) he may rely on the certainty of* Proofs *by them.* Weights and Scales.

Next to the former Directions *he must be well skill'd experienced and exercised in the* Art *of* Arithmetick, *for the numbring and casting up* Accounts *(which to* Assaying Coins *and* Refining *Works are very necessary, and is one of the* Master-pieces *in this* Metallick *ART) And every* Assayer *must not only diligently learn this* numeral Science *(necessary to be known for the* Proving *of* Metals *or what belongs thereto) but also all such* Arts *and* Sciences *as may accomplish his full* Designs *therein.* To be skill'd in Arithmetick.

Now

Now, though it would not have been unserviceable to have writ of all ſuch things more largely in this Preface *and* Entrance *to what follows, as alſo of the* Riſe *and* Springs *of* metallick Oars, *and how they* grow *in the* Mountains, Veins *and* Chanels *of the Earth, and how* generated *(of which the old and later* Philoſophers *have had many different* Opinions) *as alſo of the* Streams, Chanels *and their* Entervals *(and other Accidents which do diſcover and produce* Oars, *whereby the* Miners *do guid themſelves in their Proceedings and* Works.) *Yet becauſe it would have been too long and endleſs to recite the* Opinions *of* Philoſophers, *and the various* Operations *of Miners (in reſpect they do not agree in all things, and miſs very much of their Aims, and have written many* Books *to little purpoſe) therefore, for brevity ſake, I have omitted them, and propoſed only my own* Practice, *for the better advancing this Metallick ART.*

THE

The first PART,

Consisting of V. BOOKS.

The CONTENTS *of the* Chapters *and* Sections *of the first BOOK.*

CHAP. I.

of Silver Oars.

SEction 1. The I. SCULPTURE Deciphered. 2. The II. SCULPTURE Deciphered. 3. The purpose of this first Book. 4. Why Silver in the first place.

CHAP. II.

How Silver Oars *are distinctly known.*

SEction 1. Of the difference in Assaying Oars, and of the several sorts of Silver Oars, as followeth. 2. Of Glassy Oars. 3. Of white Goldish Oars. 4. Of Horny Oars. 5. Of Red Goldish Oars. 6. Of Black Oars. 7. Of Ironish Oars. 8. Of Leadish Oars. 9. Of Glittering or Bismutick Oars 10. Of Float Oars. 11. Of Azure or Mountain-Green Oars. 12. Of Flinty Oars many sorts. 13. Of Blanch, Cobolt, mispeckle or speckle Oars. 14. Of Glimmer, Wolferan, Talk, Cat-Silver and sparkling Oars. 15. Of Spelter or Spizy Oars. 16. Of Spady Oars. 17. Of Slacks and Copper-Stone Oars. 18. Of the wayes of Assaying them.

CHAP. III.

How the Assay-Ovens *to prove* Silver *and other Metals are to be prepared and made.*

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How Muffles, Bottom Plates, Tests, *and other small Potters Works are to be made for* Assays.

SEction 1. The Assayers are to be skill'd in making them. 2. Of making the Loam for them. 3. The Frame for Assay Tests. 4. To make Muffles. 5. How the bottoms of them are to be framed. 6. Of drying and Calcining the Loam. 7. The IV. SCULPTURE Deciphered.

The CONTENTS

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CHAP. VI.

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CHAP. VII.

How good Clar is to be made for Copels.

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CHAP. IX.

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In the ſecond Part of ESSAYS,

THERE are the Twenty four *Engliſh* Letters, artificially Cut in Wood: and two more SCULPTURES Engraven in Copper. *viz.* under the Word *Limbeck* one, and *Load-ſtone* the other.

THE

THE *best* Artists *may commit* Mistakes *or* Errors, *but they are Pardonable, when they proceed not from a* willful *and* careless Neglect, *and therefore 'tis hoped that the Ingenious* Reader *will connive at the want, or misplacing of* Comma's, Periods, *or* Parenthesis, *and for the rest they are here set down, that there may be no Mistake in the Sense of the* Author.

PAge 12. *Line* 24. *for* Essay, *read* Assay-Oven. *p.* 38. *l.* 15. *r.* Petre. *p.* 63. *l.* 13. *r.* Needles. *p.* 72. *l.* 2. *r.* Blink. *p.* 75. *Fig.* 7. *r.* a compleat unused. *p.* 89. *Fig.* 7. *r.* the Fork and Pendula. *p.* 103. *l.* 24. *r.* a black Hair Sieve. *dele* Sicher Troy. *p.* 114. *l.* 27. *r.* rough Stenes. *p.* 118. *l.* 15. *r.* Sandiver. *p.* 154. *l.* 3. *for* washeth *r.* weighed. *p.* 167. *l.* 16. *r.* which you. *p.* 171. *l.* 15. *for* Rape *r.* Linseed. *p.* 181. *l.* 14. *r.* Silver. *p.* 186. *l.* 14. *r.* hath. *p.* 189. *l.* 2. *r.* put in. *p.* 242. *l.* 17. *r.* with which. *p.* 252. *dele* 12. Necessary *r.* Profitable. *p.* 280. *for* Loths *r.* pounds. *p.* 287. *Fig.* 2. *r.* How the, *ibid* *Fig.* 6. *r.* Wind-holes. *p.* 313. *l.* 2. *r.* Tin by. *p.* 333. *dele* 3, 4, 5, 6, 7, 8. *r.* 4, 5, 6, 7, 8.

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BOOK I.

CHAP. I.

Of Silver Oars.

Cap. I.

Sculpture I.

Section 1.



Deciphered.

The *Assayer* 1. the *Scales* 2. the Cases for *Weights* 3. *Glasses* for Aqua Regis, Aqua Fortis, Aqua Vitrioli, Aqua Argentea or Quicksilver, &c. 4.

CAP. I.
Section 2.

Sculpture II.



Deciphered,

1. The form of an *Athanor* or great *Furnace.*
2. The *Forceps* or *Tongs* and *Fork.*
3. The *Coppel* or *Test*, with Philosophers *Bellows.*
4. The *Digestive Pot* with its *Cover* and *Fire* about it.
5. A cover'd *Crucible.*
6. The long Bell, or *Matras-Glass* on a *Sand Furnace.*
7. The *Wind Furnace* with a *Blow-pipe.*
8. A *Furnace* with a *Copper head*, and its *Receiver.*
9. A *Furnace* with a *naked* and open *Fire.*
10. The *Pestel* and *Mortar* , with one beating the *Metals.*
11. The *Owl's Head*, or another form of a *Cover* to the Figure 8.
12. *A Retort.*

THIS

CAP. I. Section. 3. *The Purpose of the Book.*

THIS *first Book* speaks of *Silver Oars*, how they may be distinguished by their several Sorts, and afterwards by *Assay-Scales* and *Assay-Tests*; Of *Muffles*, *Coppels*, and of *Clar* for *Lead*, of *Lead-Glass*, of *Fusion-Pouder*, of *Ballances* and *Weights*, and how a *Lead Grainer* may be made, and then how every particular sort may be certainly assay'd or tried, as also of *Slake* and *Slake-stone*, *Flakes* and *Hard-Work*, of *Laech-Speize*, *Black Copper*, *Pagment*, and of *Granulations*; as also of *Planches* or *Plates of Silver* and burnt *Silver*, with a fundamental Information how to burn *Silver* in the common way, and under the *Muffle*: as also the preparing and making *Tests*: and how to cast *Silver* which is *Tuff* or *hard*, as well as that which is not *tuff* or more *ductile*: also how to assay *Tin*, *Iron* or *Steel* for *Silver*, and to know what any *Silver* or *coined Mony* is worth: and to make *stroking* or *touching Needles*, or *Ingots* of *Silver* for distinguishing the *fine* from the *less fine Silver*.

See the Dictionary.

4. *Why Silver first treated of.*

Now, because I have in this Treatise first begun with the Description of *Silver Oar* and its *Tryals*, some may wonder why I did not rather begin with *Gold*, (which is treated of in the Second Book) and why I did not give *Gold* the Preheminence, it being the highest and chiefest *Metal* of the Earth, and so by right it should have been first treated of.

Therefore I think fit to inform the READER that I have not done this without good Reason; For, from *Silver Tryals*, all other Assays and Preparations of *Instruments* do flow, as out of a Fountain, and have their Rise from thence; for which cause I have judg'd it necessary, in the first place, to give information of the same, and to place it in this first Book, because it is

CAP. I. to the Honour of the Crown of *Bohemia*, and bordering Countrys in *Germany*, viz. *Miechsin*, *Sachsen*, *Shesren*, *Manhren*, and other Countrys where there are many *Mines* containing good Quantities of *Silver*, and many *Miners*, *Gardians* of *Mines*, *Refiners*, *Provers*, *Smelters* and *Melters*, who exercise themselves in proving of *Silver-Oars*, and of such Metals as contain *Silver* in them, and yet because there are many in these parts who have not gained the true Knowledge thereof, or have not in all things pertinent to this Science, obtained a fundamental Information, I have proposed to my self to be serviceable to such, and therefore I have more largely treated of *Silver*, and its *Tryals* than of any other *Metals*, and am not willing to leave this unmentioned in this entrance of what I am to write.

CHAP. II.

How Silver Oars are distinctly known.

I. Section SIlver *Oars* are found to be of many sorts and Colours, yet if they be not very fine, they are not to be judged by their Looks (how rich soever they are in *silver*) and therefore 'tis proved by Artists (who have diligently search'd into this *Science*, and by them found out many years past, as also by others who have since improv'd this *Art*) that the worth of every *Oar* may be certainly found out, so that the very *smelting*, *melting*, *refining* and account thereof, may be demonstrated both as to its *worth* and the *Charges*.

Now

Now it is here neceſſary to be known, that ſo many as there are *Sorts* of *Silver Oars*, ſo many are their *Natures* and ways of *melting* and *refining* them; and therefore the *Tryals* of *Silver Oars* muſt be ordered according to the *Nature* of the *Oars*, becauſe the *hard, harſh, groſs* and *crude Oars*, cannot be proved like thoſe of an *eaſier Fuſion*; or of a more *mild, ſubtil* and *ductile nature*, becauſe, as an *Oar* proves either *harſh* or *hard* of *fuſion*, ſo it muſt be help'd (in the proving) by the *Government* of the *fire*, or by other wayes; as, by much Experience in proving ſuch *Oars* have been and may be diſcern'd according as they *melt* in the *fire*: ſo that if there be not a knowledg of the Nature of an *Oar* before *melting*, and how it will do in the *fire*, ſuch an *Oar*, cannot be melted to profit. CHAP. II. *Difference of aſſaying Oars.*

Now for the better attaining the knowledg of the *Difference* of *Oars*; as, which are of an *eaſy*, and which of an *harſh* and *crude Fuſion*; the moſt excellent and experienced *Miners* do give every *Mine* (and *Oar* from thence) *Names*, according to their *Natures*: all which according to the Terms uſed by them are hereafter named.

Section 2. *Glaſs-Oars*

Firſt, there are reckoned to the *Eaſy-flowing Silver-Oars*, theſe *Nominall diſtinctions*, viz. *Glaſs-Oars* (as the cheifeſt of the *leaden coloured Oars*) almoſt to be compared to the beſt *digeſted Silver*, for it doth not looſe above a ſixth part in the fire, and the reſt is pure and *good Silver*, and this *dig'd Oar* is accounted the beſt *Silver Oar*.

3. *White goldiſh Oar.*

Alſo there is found *white-Goldiſh Oar*, not that it contains *Gold*, but becauſe it is good in *Silver*, it hath this name in reſpect of its Goodneſs.

4. *Horn Oars*

Alſo the *Horny Oar*, (which is called ſo from its tranſparency or rather lucidation like *Horn*) and is very *rich* in *Silver* next to the three laſt mentioned *Oars*.

CHAP. II. Section. 5. *Red goldish Oar.* There is a *Silver-Oar* which is *Brown-red* (almost like *Cinabar*, but not so light) and this they call *Red-goldish Oar*, and this doth yield above *half Silver*, and it is found that these *Oars* do break like one another, and the difference not easily discern'd.

6. *Black Oar.* As for all *Oars* which are *gray* and *black* in *breaking* and withall heavy, they are often *rich* in *Silver*, but such as break *black* and *light*, or *brown* and *yellow* are *not* allwayes *rich*, and it happens often that there is little or no *Silver* in them.

7. *Ironish Oar.* All *Ironish brown* and *yellowish streamy Oars* are from decaying Mines, pierc'd by cold *winterly Winds*, and these contain some, but are not rich in *Silver*.

8. *Leadish Oar.* Also the *leadish*, or *Oar* that looks *like mud* (and therefore call'd *muddy Oar*) is somtimes *rich* and somtimes very poor in *Silver*, and indeed all *leaden*, *horny*, *stony Oars*, if they be *yellow*, *white*, *gray*, *black*, *brown*, *red* or *green* do not contain in themselves (if no other *Oar* be mingled with them) much *Silver*, and for the most part *none* at all.

9. *Glittering Oar.* Also there is reckoned among the *Easy-flowing Oars*, all such *Lead-Oars* as are of a *bright*, *glittering*, *shining* Nature, or of a *gray*, *brown* or *white Colour*, yet these of themselves alone have little *Silver*, but the small *flaky glittering* or *Wismet Oars*, from the *Mines* in *Bohemia*, as also the much *flaky*, *shining Oars* from the *Mynes* of Fryburgh in *Misnia*, do contain from 6 to 10 *ounces* in a *centner*.

10. *Float Oars many Sorts.* Also all *float* or *Easy-flowing Oars* that are *Yellow*, *white*, *brown*, *blew*, *green*, or *gray*, do contain near that *proportion*.

11. *Azure or blew Oar.* Also *Copper-grass Oar* or *Copper* of a *Mountain-green*, or *Copper glass-Colour* do hold some *Silver*, but the *Course Oars* of an Azure, *Mountain-Green Colour*, are comonly *poor*.

In

CHAP. II.

In fine, all *Silver Oars* in all sorts of *Mynes* free from *Flint, Blent, Cobolt, Mispickle, Glimmer, Wolferan, course spelter* and *Wismet* (or be *spizy* and *Copery*) are called, saft flowing *mild Oars*. *See the Dictionary.*

Section. 12. *Flinty Oars many Sorts.*

On the contrary, all *flinty Oars* are reckoned among the *harsh, gross* and *hard flowing Oars*, and of these *Oars* there are also several sorts, namely the *gross Flinty-Oar*, the *water flinty-Oar*, and the *square flinty-Oar*, these contain *little Silver* (and the most part of them none) or not above half an ounce in a *Centner:* also *Copper-flinty Oars* that are *yellow like Brass*, also the *Brown* and *Blew-staind-Flinty Oars*, they do contain much good *Copper* (as may be Seen in the third Book) but such *Oars* contain *little Silver*, yet one sort more than another.

13. *Cobolt, blent mispickle Oars.*

There are also *rich-copper-Flinty Oars* which have *no Silver* but the *Blent, Cobolt* or *mispickle Oars* (as in Section 11.) if they be *speckled* or spotted with round *black* or *gray spots*, they are sometimes *rich* in *Silver* and sometimes *poor*.

14. *Glimmer, Wolferan, Talk, Cats-silver* and *sparkling Oar.*

Also all *common-white Glimmer* or *wolferan* (as in Section 11.) or *glimmering* or *sparkling Oars*, or *Talk* or *Cat-silver* are very *poor* in *silver*, yet the *black Glimmers* are sometimes *rich*; but for the most part all such *glimmery Oars* are commonly *poor*, so as I account these but as Paterns to other metalick Oars.

15. *Spelter* and *spizy Oars.*

Also all *course-Spelter, spizy* or *coppery-spizy Oars* (as in Section 11.) or the like kind, they are commonly *poor* in *Silver* and contain none at all.

16. *Spady Oars.*

Also all *spady Oars* (or such as may be dig'd with a Spade (if they be *red, green, yellow* or *white* (if there be no other mixt *silver-Oars* with them) for the most part do contain little or no Silver in them.

17. *Slack* and *Copper stone*

Also there is reckoned among the *harsh*, or *hard-flowing Oars*, the *raw slack-stone*, and *copper-stone, spelter*, be-

ing

Chap. II. ing alike in cleaving and ſplitting of Furnaces which proceeds from the ſtirring of the flinty parts,as alſo from the ſcummy part in melting them.

Section. 18. *The Ways of aſſaying them.*

But how the *Proofs* of the above-named *ſoft-flowing*, as alſo of the *hard-flowing ſilver Oars* are to be wrought, I ſhall by the following Discourse diſtinctly and exactly inform the Reader.

Now, becauſe that in many places there are no Workmen who can well make *Inſtruments*, belonging to the proving of theſe *Oars*, I will for the better Information, ſhew firſt what is chiefly neceſſary to be done in ſuch proofs, both in the whole, and in parts ; as alſo what matter or ſtuff is to be uſed about them ; as alſo what *Inſtruments* are to be made and prepared for them.

CHAP. III.

*How the Aſſay-*Ovens *to prove Silver and other Metals are to be prepared.*

Section. 1. *Special Ovens.*

THERE muſt be *ſpecial Furnaces* (for *Aſſaying*) made of good *Potters Clay*, and bound with ſtrong *Iron wyre* or *Hoops*, that they may not fall aſunder by reaſon of the ſtrong heat which they muſt endure. But ſome diligent *Aſſayers* which intend to carry on their Work effectually, do form and adorn their *Furnaces* fairly and comely, ſo as they may be pleaſing to the Sight : This indeed do's give them an adornment, but there is no more done with it,than with a *Common Furnace* (that is made well, though plain.)

Adorning them.

Now there are many ſorts of *Aſſay-Ovens* which *Aſſayers*

ſayers made uſe of according to their ſeveral wayes of working, but this is to be noted, That in one Oven, the Fire is to be better governed than in another, either by heat or cold, as the difference may be ſeen in the following *Sculpture:* But I intend to mention firſt, how the *Ancients* have made their *Furnaces.* CHAP. III.

Section 2. *Iron Aſſay Ovens of the Ancients.*

The Common *Aſſay-Ovens,* in which the *Ancients* have made ſmall Tryals, they have cauſed to be made ſquare, of ſtrong iron Plates about fifteen Inches wide below, and ſixteen Inches high, and ſloping from below to the top, ſo that the ſquare was about ten Inches at the top, and this Square had no Bottom, but in the Fire part it had a Mouth-hole (of four Inches and a half wide) and the other three ſides had each of them at the Bottom a *wind hole,* four Inches long, and one and an half high: there was alſo every where about the plate, holes cut into it, ſo that it was ruffe and ſharp for the *Loam* to ſtick the better to the luting of their *Furnaces.*

To make a good Loam.

Now to make ſuch a ſpecial good Loam, (as will hold well in the fire) take good and well-wrought *Loam,* beat among it *Flocks of Wooll,* or *Horſe-dung, Blood of Oxen, ſcales of Iron* and common *Salt,* with which *lute* the *Furnace* two inches and a half thick, let it dry, then take ſmall ground *Venice-glaſs, Bone-aſhes,* and a ſmall quantity of *Loam,* mingle it well together, and plaſter it all over the inſide of the *Furnace,* let it dry well, then make a gentle fire in it, that it may be *neald,* and when the Furnace is to be uſed, there muſt firſt be a ſmooth fire-place, and upon that *Copell*-Aſhes are to be laid the breadth or thickneſs of a finger, and this on the *Furnace* muſt be placed; and in the Oven upon the Fire-place a *Muffle* (which is formed as the following *Sculpture* doth ſhew:) and thus the *Aſſay-Oven* is made ready: and when there is any

CHAP. III. Tryal to be made of the *Furnace*, after it is well glaz'd within by the laſt plaſtering over of the Furnace with the *Venice-glaſs* and *Aſhes*, it will laſt the longer.

And when the Furnace in length of time is quite burnt out, then the old Loam is only to be knock'd out, and freſh put in the room thereof, and proceed as before.

In ſuch a *Furnace*, he that knows well the Government of the Fire, and is an experienc'd *Aſſayer*, may make all manner of Tryals, only the Regiſters are ſooner ſtopped with the Aſhes than the Furnace with the two mouth-holes, of which there will be information hereafter.

Section. 3. Norinberg *Aſſay Ovens made of Potters Loam.* Some *Aſſayers* do uſe in their tryal of *Furnaces* (which are made of *Potters Clay*, and formed like the above-named Furnace) and tye them with wyre, and ſet them upon a foot which is broad and hollow, and hath in each of the four ſides wind-holes (as the following Sculpture will ſhew.) And in this Furnace it is more eaſy to govern the Fire, than in the above named *Furnace*, becauſe the *wind-holes* in that *Furnace* (which are in the foot) do ſtop themſelves eaſily; and ſuch *Aſſay-Ovens* are called *Proof-Ovens* of *Noringberg*, and the *Muffles* appertaining to them, are alſo ſeen in the *Sculpture*.

4. *A ſlight Aſſay Oven of Tiles.* But if a man ſhould be in a place where no *Aſſay-Ovens* are to be had, and yet would aſſay a few tryals in haſte; in ſuch caſe, Take only a few Tyles, place them together in a ſquare, and leave in the ſides *Wind-holes*, and in the fore-part leave alſo a *Mouth-hole*, and with a Pipkin cut in two, make a *Muffle* in it, and in ſuch Furnaces Aſſays and tryals may be well performed.

5. *Aſſay Ovens in which the fire is beſt governed.* But in ſuch *Aſſay Ovens*, in which moſt commodiouſly Aſſayes may be made, and in which the Fire may be right and duely govern'd, alſo as ſuch as are not eaſily ſtop'd

ſtop'd with aſhes, and in which all the Tryals (that may be made in any Furnace) may be tryed, they are to be made thus, *viz.* eleven Inches wide, and ſixteen inches high, which is the full hight of the *Aſſay-Oven*, when you have meaſured eight inches high, then work it a little in, alſo that the Oven at the top may remain ſeven inches wide, and the thickneſs muſt be one inch and a half, and the lowermoſt Bottom three quarters of an inch thick, then meaſure from the bottom three inches high, and four inches and a half wide, which is for the lower Ovens mouth, then meaſure two inches above the lower *Mouth-hole* (which is for ſeparating of the upper and lower Ovens mouth :) in like manner meaſure the height, three inches and a half, and four inches wide, then after a ſeparation of an inch thick, make the uppermoſt *mouth-hole* about the bigneſs of a little finger, ſo that from the middle of the hole to the top of the Oven there may remain yet ſix inches and an half, then on both ſides of the *Ovens-mouth*, towards the corner, meaſure three quarters of an Inch : and make there two holes a pretty-big Fingers widneſs, which muſt go ſtrait through the Oven, as alſo the like behind : when all this is done, you muſt then alſo make a *declination*, from whence the *Aſhes* may fall ; which muſt ſtand two inches and a half from the bottom, and two inches and a half from the ſides of the *Furnace*, and the *declination* muſt ſtretch hollow upward from the bottom, ſix inches and an half : Only obſerve this, That if you intend to make any thing of *Clay*, then you muſt add ſo much as the *Clay* uſeth to ſhrink, becauſe one ſort of *Clay* doth ſhrink more than another, but moſt commonly *Clay* doth ſhrink the tenth part : ☞ When this *Aſſay-Oven* is alſo finiſhed, and is yet ſoft, then there muſt be edges cut in it, in which the *Iron-bonds* or wyer may lay, after that, let it dry well in the Sun, and then let it be

CHAP. III.

CHAP. III. Section. 6. *AssayOvens of strong Armour-plate.*

be hard baked in a *Potter's Furnace* or *Brick-kiln.* There are also in like manner *Assay Ovens* made, which outwardly are of a square form, like the above-named *Furnace*, and are made very neat and clean, of strong *Armor-plate*,and writhen with *Ironpins*, on which the *Lute* may stick well, and artificially brought together, also that such a *Furnace* may be taken asunder into five pieces,which *Furnace*,like to that of *Iron-plate*,must be neatly *luted* with a good and firm *Lute*, and to the strong plate of *Iron* at the outside of the oven,there must be little plates to put forward and backward in small Crevices, and so according to necessity the Tryal may be well made: Of such *Assay Ovens* there is much Estimation made, but there can no more be accomplished with it, than in one of the other mentioned *Furnaces*,if only an *Assayer* have well the knowledge of the Fire, after which all Proofs are to be governed, then can he, without question, do well in all these *Ovens.*

In this following *Sculpture* is to be seen how this and the afore-named Ovens are to be formed, which is thus

Deciphered.

1. *An* Assay-Oven *used by the Antient* Refiners, *joyned with Iron Plates.*
2. *An* Essay-Oven *used by the* Norinburgers (*in* Germany.)
3. *The Foot of it.*
4. *An* Assay-Oven *made of* Tiles *joyned together,which may quickly be done.*
5. An Assay-Oven *made of Potters*-Loam, *and fastned with Iron Bonds.*
6. *The upper* mouth-hole *of it.*
7. *The lower* mouth hole *of it.*
8. *The holes for* Iron-barrs *to be put in.*
9. *An* Assay Oven *made of* Armour-*plates.*

Sculpture

Chap. III.

Sculpture III.



When any one of theſe *Aſſay*-Ovens is thus prepared, then cauſe two *Iron-bars* to be made of an equal length, which muſt go through the holes that are between the upper and lower *Mouth-holes* (Figure 6 and 7) and ſtand out about three Inches, on the out-ſide of the *Oven*, on which the plate muſt reſt before the upper *Mouth-hole*, and cauſe a *bottom-plate* to be made no bigger than from the *Bars* to the lower part of the upper *Mouth-hole*, and ſo broad that it may reach a little above the *Iron-Bars*, and from the bottom-plate towards the ſides, ſo as there may remain near an inch of room on the Back part of the *Furnace*, whereby the Wind may paſs through it into the Oven, ſo that the fire may do its work.

CHAP. IV. To this *Assay-Oven* there belongs singular *Muffles*, which may be seen in their full proportions, in the fourth following *Sculpture*.

There must be also a Cover to the Furnace, with little Instruments to be made of Potters stuff, to govern the fire, the Forms of which are also in the fourth following *Sculpture*.

CHAP. IV.

How Muffles, Bottom-plates, Tests, *and other small* Potters-*Work (necessary for Assayers) are to be made.*

Section. 1.

EVERY *Assayer* ought to have so much knowledg, that in case of necessity he may be able to make his *Assay-Ovens* himself, as also his *Tests*, *Crucibles*, *Muffles* and what other *Utensils* or Instruments are daily used as necessary to Assaying, because there are not in every place Masters of this ART to be found who know how to make the same, and although much pains may be taken to instruct a *Potter* (in case of Necessity) how to make some Instruments belonging to this *ART*, yet it often happens that they do not make them well, nor in good shapes; whereby an *Assayer* may perform his Work: and therefore I (as well as others, when we could not have good Instruments made fitting for us) have been forc'd to make them our selves, which are done thus.

2. *Of preparing Loam for Instruments.* Take good *Potters*-Loam (as good as may be had) but the *Loam* or *Clay* that is blew and becomes white in the fire, is found to be the best for use; Let such

Loam

Loam dry in the Sun till it be hard, and when you do intend to make *Instruments* of it, let it be well *pulverized*, then moisten it with Water till it become soft, and let it be well troden or broken with an Iron, then put among it the Washings of *Pibble-stones* or very fine *sand*, as much as the Clay can well bear, but that you may not add too much or too little, be sure to make out of such stuff some *Assay-Tests* or *Crucibles*, and put into them some *hard-flowing* Oar and place them in the fire, which will offer thee a Tryal, whereby thou maist see, if the stuff will hold, well, sound and firm; some do mingle among it some *Chalk-stone*, or the subtile red *Talk* or *Glimmer* in such place where there is much of it, but which is most necessary, Experience will teach: some take in stead of it the broken Pots or *Crucibles*, beaten small and sifted through a fine *Seeve*, and put so much among the *Clay* that they may vvork it vvell, because of its britleness, such *Crucibles* and *Tests* as are made of it hold vvell, (but vvhen *Pibble-stones*, as hath been said before, are mingled vvith it, that it doth bind together in the fire, and the bigger the heat is, the more doth it bind) and this *Proof-Test* may be taken vvhole out of the *Frame*.

CHAP. IV.

Section. 3. *How the* Cases *and* Frames *and* Assay-*Tests are made.*

Whem the *Loam* is prepared you must then have a *Frame*, in vvhich you may beat the *Proof-Test* and *Crucibles*: the *Frames* are best made of *Brass*, but they that cannot have such may cause them to be made of good Wood of *Pear-tree*, and an *Iron-ring* may be put upon it, very closely, that the *Frame*, by reason of much use may not split or break: then anoint the *Frame* vvith a little *Bacon*, and put in it a little Ball of the prepared stuff, as much as may be enough, and grease also the upper part of the *Frame*, vvhich is called the *Monk*, and beat the upper part vvith a vvooden *Mallet* into the *Case* or *Frame*, then is the *Test* formed,

CHAP. IV.

med; press it out vvith your Fingers, but have a care that the *Clay* be not too moist, otherwise you can not press the *Assay*-Test whole out: Some do put the *Case* with the *Test* upon a suddain and quick heat, and so the *Test* will come out whole, this is a very good way to make the small *Crucibles*, but with the great *Assay*-Tests, it would be too long and tedious.

Section. 4. *To make* Muffles *of Clay over wooden-sticks or Fromes.*

To make *Muffles* you must have wooden *sticks* cut in form of that bigness the *Muffles* must be, grease them with *Bacon*, and frame a Lump of *Lute* or *Clay*, of a convenient bigness, that it may be cut with a copper wyer, into a thin leaf or piece, and put it over the sticks or frame, and cut out of it such another leaf, as may make it a half round piece, that you may close it behind, all this must be done upon the form, and must with a moist hand be stuck close to it: then let it stand, nigh three hours, that the *Clay* may be a little hardned, then cut the *Muffle* out, so as you will have it cut upon the sides and behind; and let it stand yet a little longer, that it may go easily from the *sticks*: Some do strew a little fine *sand* or *ashes* upon the *Frame* after it is greased with *Bacon*, that the *Muffle* may come easily from the Frame: But that many *Muffles* may be prepared together, therefore cause more than one of these Frames to be made, that in the mean time while one doth dry several more may be made.

5. *How the bottom of them are to be fram'd.*

But, to the bottom Leafs or pieces you must have Frames of Wood, in Widness as the bottom leafs are, thick and broad; they must be prest full with the prepared *Loam*, then they will dry quickly, and come out easily; or cut out of a piece of Clay, a leaf with a small wyer, so thick as you would have it, and shape it further as is necessary.

6. *Of drying and calcining the* Loam *for Assaying.*

These *Tests*, *Muffles*, *Bottoms*, *Leafs* and *Crucibles* thus prepared, must be very well dryed, and then in a *Kiln*

Kiln or *Potters-Oven* well calcined, although the *Muffles* and *bottom Leaves* are alſo uſed raw and uncalcined in the *Aſſay-Oven*, but there muſt be a very gentle fire, and the fire in the *Aſſay-Oven*, muſt firſt be kindled from above, downwards, and ſo they will remain whole, otherwiſe they will all fly in pieces; and thus you are fully inſtructed how the *Potters-Clay* is to be made into *Inſtruments*, and if they be not good and firm they are a great hindrance to the *Aſſayer*: the Forms of vvhich are truly to be ſeen in the follovving *Sculpture.* CHAP. IV.

Sculpture IV.



Deciphered.

1. *The* Muffles *which the ancient* Aſſayers *did uſe, and the common* Aſſayers *do ſtill.*
2. *The* Muffle *to the* Norimgberg *Aſſay-Oven.*

 3. *The*

CHAP: IV. 3. *The* Muffle *to the* Assay-Oven *with the two mouth'd holes.*
4. *Stopples.*
5. *Bottom-Plates.*
6. *Covers.*
7. *Wooden Frames or Moulds for* Muffles.
8. *The lower part of an* Assay-Test.
9. *The upper part of an* Assay Test.
10. *The* Frames *or* Moulds *for* Assay-*Tests.*
11. *The lower part of the* Assay-*Crucible.*
12. *The upper part to it.*
13. *The* Assay-*Crucible perfected.*
14. *The small* Instruments *for governing the* fire *made of Potters-Clay.*

CHAP. V.

Of Copels, *and how they may be made firm and good.*

Section. I. *Copels of good stuff.*

IT is necessary for a *Refiner* to have his *Copels* made well, because if the *Copels* be not made of good *Loam* or *Clay* they will devour the fine *Metal* very much, especially when the *Clar* is not well made which is to be put upon the *Copel*, because it will rise, and so the silver Grain will be hid under it, and if the *Clar* be not good, the silver Grain will be lost under the *Lead* and not fined. Also, if the *Ashes* be not good, or something fat or oyly, then will the *Copels* melt in the *fire*, which will prove of ill Consequence, because with such there can be no *Tryall* made.

But, that you may have good *Copels*, that your *Tryals* may be the better perform'd, make them in this following Manner. CHAP. V. Section. 2. *Of Ashes for Copils.*

Take Ashes burnt from any light Wood, (as *Sallows*, &c. for such are best for this use) and put them into a *Seeve*, and pour Water on them that the *Ashes* may be wash'd through the *Seeve* into a *Tub*, so the *Coals* and grosser parts may remain in the *Seeve*, then pour into the *Tub* so much water more, that the *Ashes* may be covered-over, then stirr it about, and let it stand an hour or two: whereby the water will draw out the *fatness* and *oilyness* out of the *Ashes*, then pour the remaining water very gently off, that the thick troubled water may not go along with the clear water; and then pour another water on it, and let it stand also till the upper water grow clear; then pour it again gently off, and this do till the water hath no *fatness* or *sharpness*: then the third time pour clear water on the *Ashes* and stir them about with a stick, as before, and pour that water, whilst it is thick and muddy, into another *Tub*, that the gross part of the *Ashes* in the first may remain till the water in the other *Tub* be clear and well setled; then let the water run clear from it again, this is the first clearing: then pour another water upon the wash'd settled *Ashes*, and stir them again with a stick; then pour the thick again into another Tub or Boul; that is to try if there remains any *Fatness* or *gross Ashes*, that it may all be cleanly separated, and let the muddy water settle very well because it is the last washing: and when the *Ashes* are thus far prepared, then make Balls thereof, let them dry well in the Sun, or in a Bakers *Oven*, and keep them clean for use.

There are some *Refiners* that in stead of *Ashes* (burnt off light Wood) do take Ashes of *Vine-wood*, (but 3. Of Vine-wood *ashes* and common *Ashes*.

CHAP. V.

(but they are not every-where to be had) and they do wash and prepare them as abovesaid, some do use only such Ashes of which the common *Lixivium* or *Lye* is made, but the two former are better, which you will also finde by use and Experience, only there must be a care that the Ashes be clear and well prepared.

Section. 4. *Of* Bone-ashes, *and which Bones are most serviceable.*

Secondly, You must have to your *Copels* good and clean *Bone-Ashes*, for which take *Bones* that have no Marrow or Gravy, and burn them white, *pulverize*, and pass them through a hair *Seeve*, then grinde them upon a stone, like Meal, and so you have *Bone-Ashes* prepared: then take two parts of the *wash'd Ashes* which have first past through the hair *Seeve*, that they may not remain in Lumps; and with one part of the ground *Bone-Ashes*, and mingle these two well together, and moisten them with *strong-Beer* (but first let the *Beer* boil away one third) or, with a *Glew-water*: But, if you will bestow somthing more upon it, then beat the whites of *Eggs* in water, and moisten the Ashes therewith, but not too much, that when you press a handful together, the *Ash-ball* may well remain intire: then let the *Copel*-case be well fill'd with Ashes and put in, but be sure to scrape the superfluous Ashes off it, and give the *Monk* three or four blows vvith a wooden Mallet upon the *Copel-frame*, wipe the *Monk* clean off, and strew (with a little wooden shovel) good *Clar* upon the *Copel*, vvhile 'tis yet in the Case, and part the *Clar* vvith your finger, and set the *Monk* strait upon it again, and give tvvo or three Blovvs to fasten the *Clar* upon the *Copel* (as necessity doth require) that the *Clar* may be fixed upon it, then take the *Monk* off, press upon other *Ashes* the *Copel* out of the Case, so is the *Copel* ready; in such a manner may you make *Copels* great and small, then let them dry till you have need of them, so vvill they be firm and good.

Munich.

Some

Some do use a special Instrument made of *Latten* which is full of little holes at the bottom, in which they put the *Clar*, and with a wyer that hath underneath a little cross-*Plate*, they cause it to run through; but I do not like it so well, as if it were parted with the finger. CHAP. V. Section 5. *An Instrument to strew the* Clar.

Some do take also among the *Copel-Ashes* the tenth part of good *Potters-Loam* (which must also be wash'd like unto the *Copel-Ashes*) and dry it in the *Sun*, and this is necessary to be used with it, and when the Clay is good and holds well in the fire: otherwise it may do more hurt than good in the *Copels*, and I conclude, when a man hath good *Ashes* that are well *washed* (as I have hinted before) good *Copels* may be made that need no mixture, and those *Ashes* may well be moistned with fair water, but the *Copels* are more brickle by it, and not so firm, as with the *strong Beer* or *glew-water*. 6. *Of Glew for Copels.*

CHAP. VI.

How good Copels *may be made, wherein the Tryals will not leap nor sparkle.*

SUCH *Copels* as I have hitherto thought fit to mention, are good to be used, by vvhich the true quantity and proof may be found in them, vvhen the Governance of the Fire is vvell observed, but if this be not minded, and the *Copel* be cool and hot, then some part of the Silver is soon lost, but if an *Assayer* is uncertain in the *Silver* and *Money-proofs*, and hath not a full knovvledg of the *Fire*, it is better for him to cause the following Copels be made for Tryals. Section 1.

Let *Knuckle-Bones*, or other *Bones* be burnt very white 2. *Bones for Copels.*

CHAP. VI. white (the *Calves* or *Sheeps-bones* are beſt) among common *Bones*) ſtamp them fine, and grind them upon a *Grind ſtone* fine as flower, then moſten ſuch ſubtile bone-aſhes (like other *Copel-Aſhes*) with *ſtrong Beer*, and of this make *Copels*, and ſtrew *Clar* on them, as hath been done with the other before named Copels, and let them dry; ſo are they prepared.

Section. 3. But good and clean *Bones of* Fiſhes may be had, (which of all *Bone-Ashes* are the beſt to be uſed for *Copels.*) When you would aſſay upon theſe *Copels*, ſet them in the Proof-Oven, and when they are only *glowing* hot, then put what you do intend to try in them and although they are only thus, the *Proofs* vvill not *leap*, but be purely finiſhed: only this is to be noted, that the *Aſſayes* upon theſe *Copels* are much colder, longer and go more ſubtilly than upon the other *Copels*, therefore there cannot eaſily any thing of *Silver* be loſt; and vvhen the proof is finiſhed than may the *Grain* be taken off very pure and clean, and nothing ſtick to it, although it had been a *Coppery-Silver* that vvas refined in it, vvhich Grains do commonly enter into the *Clar*, and they cannot alvvays be taken off cleanly from other *Copels*.

CHAP.

CHAP. VII.

CHAP. VII.

How good Clar *is to be made.*

IT is neceſſary that good *Clar* muſt be had for the making of *Copells*, becauſe if the ſame be not good, then there can be no good *Copels* made, although the *Ashes* be prepared as vvell as can be. Novv (as for my part) I have vvith Diligence try'd many *Bones*, and have found that *Calve's-head Bones* or the *Scales* that come from their Forehead are the beſt: Take them and waſh them from a boiling hot water, or let them boil well in the water, that the *fatneſs* and *foulneſs* may be ſeparated from the other, then dry them and burn them untill they be fair and white, then ſtamp and grind them on a ſtone, ſtill moiſtning them with a little water, and put them in a *glaz'd Pot* with a *Cover luted* on it, and ſet them once more in a *fire* or *Potters-Oven*, and let them burn well for four hours, then let them cool; this done, take theſe *burnt Ashes* out of the Pot, and grind them once more very fine upon a ſmooth (or *Marble*) ſtone, that they may be very clear (of which clear preparation, the *Clar* hath its *Appellation* or name) keep it from Duſt, and it will ſerve for your uſe at any time. Section. 1.

Some alſo do uſe *Harts-horn* to make *Clar*, and they burn it and order it as the other aboveſaid, and this doth yield good *Clar*, but thoſe of the *Scales* of *Calves-heads* I like better. 2. *Clar of Harts horn*

There is alſo of *Fish-bones* (as *Pike* and other *Fishes Bones*) very good *Clar* to be made, but the Fatneſs 3. *Of Fish-bone.*

CHAP. VII.

neſs muſt be firſt ſeparated from it, by boyling and burning them (as before) but this according to ones pleaſure, and which *Clar* any one likes beſt, he may uſe, only he muſt be careful to ſee that they be finely ground to *Pouder*.

Section. 4. *How to be kept.*

When the *Clar* is ground to *pouder*, then ſome do waſh it in fair water, and make four-ſquare *Pieces* of it, or *Balls* (like *Chalk-ſtone*) as I my ſelf did ſome years ſince, but I find that if it be finely ground, and dryed only, it is the better, becauſe by waſhing and drying it, and making them into *pieces* or *Balls*, they will grow hard, and cannot be ſo well ſcraped from the *Lumps*, as with that which is in *Pouder*.

Now, how the *Copel-Caſe* and the Copel is to be ordered and performed the following *Sculpture* will ſhew.

Sculpture V.



Deciphered.

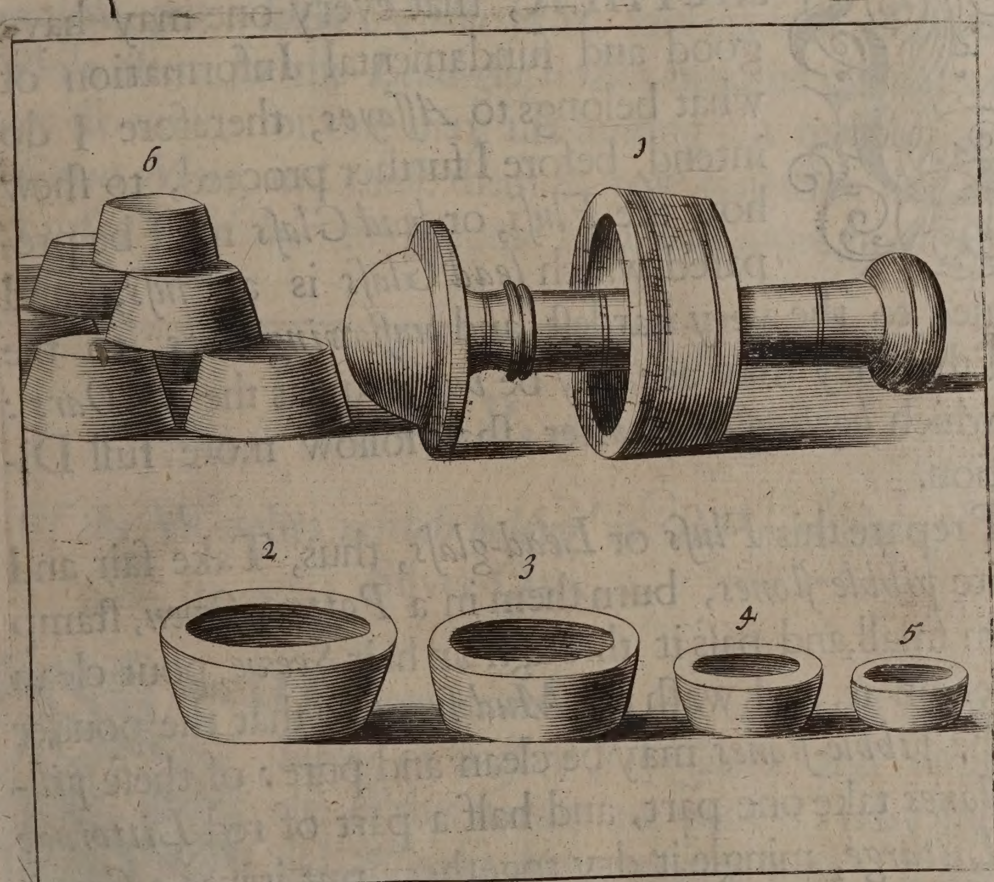
CHAP. VII.

Deciphered.

1\. 3. *The* Copel-*cases.*
2\. 4. *The* Copels *that are made in them.*
5\. *The* Copels *as they are set upon one another.*
6\. *The* Wash'd Ashes (*or* Clar) *made into Balls.*
7\. *He that works the* Ashes.
8\. *He that strikes the* Copels *into their* Frames *or* Cases.

But that the Forms and Proportions of the *Copels* may the better be seen, the following *Sulpture* doth demonstrate. Section. 4. *Forms of Copels.*

Sculpture VI.



Deciphered.

1\. *The* Copel-Case.
2\. *The* Copel *for the* Copper-Oars *and common Proof of Common Oars.*
3\. *The* Copels *for Oars that are* poor *in* Silver, *and also for common* Oar *Tryals.*

CHAP. VIII. 4. *The* Copel *for* common Siver-*Tryals, which are assayed according to Weight.*
5. *The* Copel *to* Starling-silver *Proof.*
6. *How the* Copels *are set one upon the other in the* Ovens.

CHAP. VIII.

How Glass *of Lead, or* Lead-Glass *is to be made.*

Section. 1. FURTHER, that every one may have good and fundamental Information of what belongs to *Assayes*, therefore I do intend, before I further proceed, to shew how the *Fluss*, or *lead Glass* must be prepared, which *lead Glass* is a *Fluss*, and is used to the very hardest and *unflowing Oars*, to the end that they may as easily be *boiled* up as the *soft Oars*: of which *boyling*, hereafter shall follow more full Direction.

Lead-glass to what Oars it is to be used.

2. *To prepare* Flus *or lead-glass.* Prepare this *Fluss* or *Lead-glass*, thus, Take fair and white *pibble-stones*, burn them in a *Potters-Oven*, stamp them small, and pass it through an hair *Seeve*, pour clean water on it, and wash the *Mud* from it, that the pouder of the *pibble-stones* may be clean and pure: of these *pibble stones* take one part, and half a part of red *Littorage* or *Littarge*, mingle it dry together, put it into a *Crucible*, but not above two thirds full, and put *common Salt* on the top of it, or *Salt-peter* (if such can be had) about three Fingers height above the matter, and *lute* it well; and let it flow together with a strong heat in a *Wind-Oven* or *Tyle-Oven*; let the *Crucible* cool of it self, then open it, and all will be mingled in a *yellow Glass*; only a little *Regulus* of *Lead* at the Bottom, which is to be sepa-

separated, but preserve the *Glass*, which is the *Fluss*. CHAP. IX.

You may also melt the *Littarge* first by it self, and of the *slakes* that come from it, take ten parts to one part of prepared *pibble-stones*, and cover it with *Salt*, (as above) cause them to flow, and so a good *Lead-glass* will come of it. Section. 3. *Another way.*

Or take instead of the *wash'd Pibbles*, good wash'd *Loam*, which is dry and finely *pulverized*, one part, and three parts of good *red Littarge*, cover it with *Salt*, let it flow in a strong heat, this doth yield a fair *Lead glass*. 4. *Another way.*

When the *Lead-glass* is made, and again melted in a *Crucible*, put a little *Niter* in it, and cause it to flow a while after, so the *Lead-glass* will become cleaner or more flowing: or one may use among it a fourth part of *Caput Mort.* and cause them to flow together, this also causes the *Fluss* to become finer and more flowing. 5. *To cleanse the Lead-glass.*

CHAP. IX.

Of the Weights *which belong to the proving of* Silver-Oars.

THE *Centner-weight* by which all *Oars*, *Slicks* or *wash'd slake-stones* and what else of this nature are prov'd) is by the old *Assayers* proportioned thus: That the *Centner* is orderd to be just an Hundred pound weight: for this Reason, because in many places the *Oars* or *slake-stones*, and the *silvery unwash'd black Copper* is bought by weight, and the *fine Silver* in it according to the Proof (before it is melted out of it) is paid for this end, that the Buyer may not be a Looser (because of the waste in melting Section. 1.

CHAP. IX. ing to get out the *Silver)* therefore hath he ſo many pounds as the Common *Centner* of the *Mine* yields (or where it doth weigh more or above) which *Centner* of the Mynt doth commonly weigh an Hundred and ten pounds, ſo that he may have the ten Pounds that is above, with the *Silver* in it, to help to bear the loſs) therefore in a well ordered melting of poor *Oars* they do hold moſt commonly 3, 4, or 5 *loth* of *Silver*, for the loſs of the *Silver* in Melting ſhould not be above the *Silver* contained in the ten Pounds of the *Oar*, that was over, comparing it with the proof-*Centner*: but in rich work and rich *Oars*, or concerning very rich *Copper*, the ten pounds which are above are alſo juſtly taken along with it.

Section. 2. *Of dividing the common Proof Centner.*

1 } Dram.
1 }
2 Drams or half a Loth.

1
2
4 } Loth or two Ounces.
8
16

1
2
4
8
16 A Pound.
25 A quarter of a Centner.
50 Half a Centner.
100 A whole Centner.

3. *Two ſorts of Penny weights.* The *Peny-weights* are of two ſorts, the one is with us in *High Germany*, the other is as 'tis uſed in *Holland*, after which the Silver or Grains may be tryed, upon a

juſt

just proportion how much a *Mark* hath in it of fine *Silver.* CHAP. IX.

1
1 } *Heller*, or *Half-penny.* Section 4. *Of dividing the Penny-weight in High* Germany.

1
2 } Pence.

1
2 } Drams.

1
2
4 } *Loth*, or, 4 *half Ounces.*
8
16 } *Loth* is a *Mark*, or 256 *pence.*

$\frac{1}{2}$
$\frac{1}{2}$ 5. *Of dividing the Low* Dutch *Peny Weight.*
1 } The *single Grains.*
2
3
6
12 } *Grains* is a *Half penny.*

1
2
3 *Pence.*
6
12 *Pence* is a *Mark*, or 288 *Grains.*

There are so much as 256 pence.

The *Mark* in the *Grain-weight*, is parted into *Loths* and *Grains*, like as the *Low Dutch Peny-weight* is parted into *Loths*, *Pence* and *Grains*, and this Weight is most commonly used for *Tryals* in the *Crucible* for *Coyn'd Mony*, to which it doth best serve: for this Reason, because

CHAP. X. the *Grains* here are reduced into greater Numbers, and the Contents more exactly found out, becauſe in the *Peny-weight* it is only parted into *Pence*, and *Half-Pence*, and although the fourth part of a *Grain* (as to its Contents) is not uſually reckoned, yet it is neceſſary for an *Aſſayer* to have ſuch a fourth part in his parting or ſharing for Information and Exactneſs ſake,

$\frac{1}{4}$
$\frac{1}{4}$
$\frac{1}{4}$
$\frac{1}{2}$ } *Single Grains.*
1
2
3
6
9 } *Grains* is half a *Loth.*
1
2
4
8 } *Loth*, or two *Ounces.*
16 *Loth* is a *Mark*, or 288 *Grains.*

CHAP. X.

How all Silver-Oars *are to be tryed.*

Section. 1. *Aſſaying of ſoft flowing Oars.*

I HAVE mentioned before, That a difference is to be made among *Oars*, becauſe ſome are *harſh*, *hard-flowing* and *raw*; as alſo that ſome are *ſoft-flowing* and *mild*: The *ſoft-flowing Oars* are thus to be tryed for *Silver*: Take the *Oar*, grind it with an Hammer upon a broad Iron, (fit-

(fitted to that purpoſe) as ſmall as pouder, weigh of it a Centner (with thy *Aſſay*-weight) put it on a well-made Teſt, and mingle eight times as much of *Lead* in *Grains* among it, and ſet in a warm *Aſſay-Oven*, and preſently make it hot, and ſet *Coles* before the *Ovens* mouth, ſo the *Lead* will begin to drive and turn quickly to *Slacke* or *Droſs*, and when it hath ſtood ſo long in the *Proof-oven*, that the *Lead* upon the *Teſt* is all covered over with *droſs*, then it hath *droſs* enough; (this is called *Boyling up* or *Up-boyling*) then take an *Iron hook*, lay it that it may be a little red hot, and ſtir the *Oar* with it cleanly about, which is done for this *Reaſon*, that if there ſhould ſtick any of the *Oar* on the ſides of the *Teſt*, it may be made looſe, and that the *Lead* alſo may work on it, and conſume it: After the ſtirring, let it ſtand a while, and then take it out of the *Aſſay-Oven*, and pour the *Lead* and *droſs* upon an *Iron-plate*, in one of the little holes that are to be made upon the *Plate*; and let it cool, and then ſeparate the *droſs* clean from the *Lead*, ſo is the proof of the *Upboyling* ready, which is done in the ſpace of about half an hour, afterwards ſet *Coppels* in the *Aſſay Oven*, and let them glow well for half an hour, (and this is called *Nealing*) and upon theſe well *neal'd Coppels* put your *Lead* ſo wrought, which hath been *boiled up*, and make it warm that the ſame may firſt begin to work, and when it begins to drive, then keep the fire not too high, that the *Lead* or *work* may drive well; and go off upon the *Coppel* in a convenient heat, and ſo the *Lead* will all be drawn into the *Coppel*, and the *grain* of Silver will remain alone, (provided that the *Oar* hath *Silver* in it) upon the *Coppel*, although it be very ſmall, then take the *Coppel* out of the *Aſſay-Oven*, and take with your *Pincers* the *Grain* from it, ſo is the proof finiſhed: Now, how this *Grain* is to be weighed, with the *Aſſay-Scales*; it doth require a ſpecial diligence;

Chap. X. Section. 1.

CHAP. X. Section. 2. *Tryals of harsh Oars.*

gence; and of this you shall be more exactly instructed afterwards.

You shall *Assay* these *harsh* and *hard flowing Oars* in this manner, Take the *Oar* ground small, and weigh of it a Centner with your *Assay-weight*, put it on a good *Test*, and add to it its due weight of *Lead*, to wit, Fourteen *Centners*: set it in an *Assay-Oven*, and give it presently heat, that the *Lead* in the *Assay-Test* may begin to drive, as you have done with the *soft-flowing Oars*, and when the *Lead* begins to drive, then let it be cold again, which will be, when you do shut the lower *mouth-hole*, and do open the *upper*, then will the Oar rise, and come to be *roasted* upon the *Lead*; when it is roasted enough upon the *Lead* (that is when it is seen to leave smoaking much and begins to *flacke*) then maist thou give it heat again, as much as can be. This happens when you do lay Coals before the upper *Mouth-hole* of the *Assay-Oven*, so the great heat will force it, that the Oar will turn to *flackes*, but it doth *flacke* small and not easily, and when the *Oar* is almost *boyled up*, and hath *flacked finely*, then stir it cleanly with an *Iron-hook*, let it stand again a pretty while in the *Oven*, and when all is turn'd to fine *flakes*, then pour it as before upon a *Plate* hollowed, or let it cool in the *Test*, and beat the *flackes* from it, so is the proof of *up-boyling* ready.

3. *A quick up-boyling of Silver Oars*

In such manner, almost, may all *Pibbles* or *raw Oar* be *boyled up*, and this is a right and good way to do it, but the *up-boyling* is hardly done in an hour, yet it may be done sooner in this manner; when you have weighed your *Oar*, and set it on the Test without *Lead* in the *Assay-Oven*, give first some heat until the *oar* upon the *Test* is *roasted*, and smoak no more: then set the *Lead*, (as much as belongs to the Tryal) upon the *Test*; give it a great heat, so will the Oar *boyl up* something easier, and in less time than if it should have been roasted upon the *Lead*.

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Although there are ſome that believe ſuch a Tryal in which the Oar alſo is *roaſted* without *Lead*) is falſe and not right, yet I do give this Information, That I have oftentimes, (with one ſort or other) tryed both wayes, and I do truly affirm, That I have found no difference: But there muſt be a Care taken, that when the Oar is ſet alone upon the *Teſt*, that it may not be put into a violent ſuddain heat, becauſe ſuch an heat doth raiſe the ſmall Oar, and doth cauſe it to duſt away, eſpecially when the Oars are *ſtony*, for it makes the Tryal falſe (this excepted) I know no fault, but be carefull and you will find it true. CHAP. X. Section. 3.

Some have alſo another way to try *raw mild Oar*; as thus, They ſet firſt the *Teſt* in the *Oven*, that it may glow, and then put the Lead in it, and let it by it ſelf *ſlack* pretty well, after that put upon the *ſlack'd Lead*, the *weighed Oar* in ſmall Papers, ſo the hot *Lead*, and hot *Slack* will draw the Oar quickly to it ſelf, and will not let it *riſe* much, or *boil up* very well: this way I alſo like, only that in drawing the Oar upon the *hot Lead*, (eſpecially the mild *Oars*) it will duſt, and when there are many Proofs to be made together, there will ſomething be neglected, and the Proofs may become falſe. 4. *Another way to try raw Oar.*

If one doth know the Nature and Property of ſuch Oars as will not eaſily boil or *ſlack*, but remain upon the *Lead* (for ſo will the Chalk-ſtones) the *groſs* and *raw blind* or *Cobolt*, the *miſpeckle*, as alſo the *mild* and *freſh Pibbles* and *water-pibbles* which muſt (aſſoonas they are weighed) be mingled with *Flus* or *Lead-glaſs* (as hath been before mentioned) which vvill hold the *raw Oar*, and doth not ſuffer it to riſe high, becauſe it hath help by the *Lead-glaſs*, ſo that it vvill become ſoft *Slacks* and ſlacks vvell, and boyls up clean, as may be ſeen in melting: *harſh Oars* (vvhich in *Up-boyling* each one by his proper addition may be helped) that they vvill be vvell 5.

CHAP. X. ſeparated, or elſe there vvill remain ſome *Silver* in the flacks, and ſo there vvould be ſome Dammage.

Section. 6. *Of Aſſaying the* Copper flacky *Oar.*

In S. *Joakims* Valley (ſo called) there are Oars broken, vvhich are called *Coppery-Oars* or *flaky Oars*, vvhen they are once *boyled* up, the *Work* or *lead* vvill not go off upon the *Coppel*, but caſts up a Ring or *border*, and eats much in,and makes the *Proof* falſe: and vvhen this is knovvn by an Oar, then muſt the vvork or *Lead* vvhich hath been boyled up (and from vvhich the *droſs* is ſeparated) be again ſet upon the *Teſt*, and be ſlack'd again, and then the *Lead* vvill come off clean and *white*; This is called, the *Lead cleanſed* of its Foulneſs, then it muſt go off upon the Coppel, as before.

7. *Cleanſing of the groſs* ſulphuryFlints *after Up-boyling.*

It happens alſo often, that the *groſs Sulphury oars* do alſo make the *Lead black* and *harſh*, alſo that upon a well *neal'd Coppel* it doth not *drive*, but leap off, which makes the Tryals oftentimes come falſe, becauſe of its Foulneſs, ſuch *Lead* you muſt once more ſet upon a new *Teſt* or upon the ſame, and let it ſlacke again, ſo will it be white and clean and go well off upon the *Coppel*, and looſe nothing.

8. *To try* Cobolt Oars.

Concerning the *Cobolt oars*, there are many ſorts of them, ſome *freſh* and ſome *milde*, *black* and *gray*, ſome in trying do go eaſily into the *Lead*, but ſuch *Lead* that comes by *Up-boyling* from it,is *black* and *red*, and it afterwards doth work upon the *Coppel*, and diſſolves, therefore it muſt after the firſt *Up-boyling*, be cleanſed again of its Wildneſs and muſt be ſlackd once more, ſo it will become white, and go clean off from the *Coppel*: One may alſo ſet the weightieſt *Cobolt Oar* in a *Teſt* in the Oven, and let the ſmoak paſs away, ſome of which ſort do leave gray *Aſhes*, and ſome a black grain upon the *Teſt*, and the reſt will burn all away, but put a little Lead to it, and it will eaſily go in it, and alſo go

clean off from the Coppel, and is found alike with the other Tryals. CHAP. X.

But ſome do take it as above-mentioned, That when the *raw oar* upon the *Teſt* is *roaſted* without *Lead*, the *roaſting* doth take away ſome of the *Silver*, and that the *groſs Sulphur* doth carry it away, and they will demonſtrate it by ſome *volatile raw Flints*, and the *raw ſlackeſtone*, which comes from it; which after they are *roaſted* do not yield ſo much *Silver* as if they were melted *raw* through the *Furnace*, to which I do yield, and have found the ſame true: But becauſe the *roaſting* generally in the *great* Work with quantities of *oars* is done in the *naked fire*, in which it alſo muſt lye ſeveral hours; contrariwiſe in the *Aſſay-oven* and *ſmall Proofs* there is but little *oar* put in, and that in a cloſe Fire is *roaſted* in a ſhort time, I judg for certain, that through ſuch roaſting of the Oars in the *Aſſay oven*, nothing can be loſt of the *Silver*.

Section. 9. Roaſting Oar in the Ovens.

Some may ask, If this way of *uſing*, *trying* and *boyling up* of Oars in the *Teſt* (and to let them ſo go off in the *Teſt*) be the right way, or no, by which the true worth, and how much *Silver* the Oar contains in it may be known? To which I anſwer, That this is the right proving, after which the *melting Works* may be ordered, and ſet up: But the true worth, how much *Silver* the Oar hath in it, is not found there.

10. Probation by which the right and full worth may be found.

But to know this, Set a great Coppel (as is uſed to *Copper Aſſayes* for *Silver*) in the *Aſſay-oven*, and *neal* it well, and put ſixteen Centners of *Lead* in it, let it begin to drive, then put one *Centner* of the *ground-oar*, which muſt be parted into many parts, and put it in ſmall Papers, one after another, when the one part doth come firſt on it, it will ſeem *ſtubborn* upon the *Lead*, and vvill cover it all over, but let not this hinder thee; Do it firſt a little cool, and then hot, ſo it vvill ſoon *ſlack* in the

Coppel,

CHAP. X. Section. 10. *Coppel*, and the *flacks* vvill paſs avvay, then ſet an other part of the Oar on the *Lead*, and that vvill do like the firſt, vvhich *flackes* vvill ſoon paſs avvay, then put in like manner the Oar all ſingly upon the *Lead*, and it vvill all paſs clean avvay in the *Coppel*, ſo that it vvill hardly be diſcerned, but ſeem like any other vvork upon the *Coppel*.

In this manner may all other Works (if they be *flowing* or *harſh*, as alſo melted *flack ſtone* and *Copper ſtone*) be tryed through; in vvhich you vvill finde a great difference, if you try the other uſual Way of *Refining*, but this vvay cannot be uſed generally, except of all Oars that are *melted*, to flacks vvhich are not altogether without *Silver*; therefore the common way of *Aſſaying* (with the *Up-boyling* upon *Teſts*, of which all flacks do come, which cannot be wholly without *Silver*) is the beſt way: I have only mentioned theſe *Aſſayes*, to demonſtrate, That with the ſame (out of every Oar) the right and full worth of *Silver* may be found in it, as fully as in the other Common *Aſſayes*: For ſeveral years, ſome vvorthy *Aſſayers* have weighed the Oars with the *Cent-*

11. *To try with Lead glaſs.* *ner-weight*, which they intended to try upon *ſilver Proofs* mingled with *Lead-glaſs*, and covered with Salt in a *Crucible*, and placed it before the *Bellows*, and did melt it into a *Regulus*, after which when the *Crucible* vvas cold, then have they beaten out the *Regulus*, and together vvith the flackes have ſet it again upon a *Teſt* in an *Aſſay-Oven*, and cauſed it to flack fully, vvhich vvay is nothing vvorth, eſpecially vvhen many *Oar-Proofs* are to be made: then *Refiners* have ſoon ſeen it, and have

12. *When many Oars are to be tryed.* thereupon ordered their Tryals according to our vvay.

Here I muſt mention alſo, That vvhen an *Aſſayer* hath dayly much to try (to vvhoſe hands vvithout Queſtion *harſh* and *hard-flowing* Oars come often) and if he be then vvell skill'd he knoweth by much and daily

ly Experience and Practice) how each Oar is in the *Tryal*; therefore when he hath prepared the Oar for *Assaying* (and so he must because of the many sorts) use a bigger *Assay-oven*, that he may set several Proofs together at Work, whereby his Tryals may be made the sooner, and must keep this Order, when he will set his *Assays* in the Oven, if they be 8, 9, or more, he must place them accordingly upon the *Assayes*, which are prepared in this manner; *viz.* That always the *hard-flowing* Oars may be hindmost in the Oven, and that the *soft-flowing* may stand before: for they are soonest *boiled up*, and so may be taken out of the Oven without hindrance to those that must be longest in the fire, and then be cast upon an Iron-*plate*, vvhich Plate must be made thus, It must have as many Holes and Vents as there are *Tests* to be set in the *oven* at once: so that each Oar may be poured out from its ovvn *hole*, that you may not mistake: But if it should happen that (because of thy many *Tryals*) you must have above one *Furnace*, then put all the *hard-flowing* Oars into one *Furnace*, and the *soft-flowing* into the other; othervvise you must stay one *Tryal* for the other, which would be an hinderance. This vvay of *Assaying* is at *Kuttingburgh* (because of the great Oar-Trade in common use there) so that in some places every Week 200 *Tryals* of Oars are made, and the Contents are delivered to a *Dram*. CHAP. X.

Take Notice, That it is vvith this, as vvith other *Tryals*, (as was before mentioned) only have a Care that you make use of an *Assay*-weight which may not be too little, and to have good and quick Scales upon which you may know the weight to a *dram*, or the fourth part of an Ounce, so then if you do well with the *Proof* in the Fire, then may you safely and surely give in the true Contents of as many *Loths* and *Drams* as you do find, after that one is weighed. Section 13. *To assay to a Dram.*

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CHAP. X.

Section. 14. *How to weigh the tryd grain.*

Further, take Notice, That when thy *Tryal* is made and that you will draw up or weigh your ſmall *proof-grains*, let your Scales be kept in a *Caſe* of *Glaſs* (that the ſame may be preſerv'd from the Wind and Duſt) then put into the one *Scale* the ſmall *grain* of *Silver*, and into the other the *grain* of *Lead* (as ſmall as it is) and put as much of the *Aſſay-weight* to it, that it may ſtand even with the *grain* in the other *Scale*, when this is done, then change the *Scales* that are in the *Proof-ſcales*, and ſee if the *Scales* ſtand even as before, if then the Proof be found alike on the one ſide as on the other, and juſt with the weight, then may the ſame be judged true, and be given in.

15. *To boil rich Oar with Fluſs.*

Such *ſilver* Oars as are very rich may alſo with the *Fluſs* (made of *Salt-petre* and *Argol* as ſhall follow hereafter) be mingled and put into a *Crucible* and covered over with *Salt*, and may be melted like unto the *Copper* Oars before the *Bellows*, and there will be a *ſilver Regulus*, in the bottom of the *Crucible* (which is not very *tuff* nor pure, becauſe of other incorporated *Metals*) the which you may make fully tuff upon a *Teſt*, and in this manner the *ſilver* is very eaſily to be had out, but it is not the true *Contents*, becauſe the *Slacks* do yet contain part of the Silver in them, the *grain* alſo doth not come very fine from the *Teſt* except it be done upon the *Coppel.*

CHAP.

CHAP. XI.

Chap. XI.

How poor Oars *of* Silver *are to be Assayed.*

AS for *poor* and unclean *silver Oars* which are mingled with stones (and yet may be wash'd off with water) *Assay* them thus; stamp and grind them in an *Iron Morter* very fine (like flower) mingle all well together; and weigh 28 *Centners* of it with the *Assay weights*, then put it into a smooth *Tub*, wash it with water till it remain like a fine *slick* or *Clay*, then weigh this wet *slick* and you will find how much those Oars do weigh and afford of clean *slick*, in one *Center* (because the *slicks* that are made clean by washing are also weiged vvet) try it upon *silver* (as you have been taught above) after such a *Proof* you may make your Accounts: and if by preparing and vvorking thus you can subsist: such a Proof hath preserved many an *Assayer* from danger of loss. Section. 1.

CHAP. XII.

To try Muddy-vvater *springs of* Silver.

SOMETIMES it comes to pass that from *mild silver Veins*, there springs out of the Mountain a blackish or yellowish *muddy water*, which doth often contain Silver: this you must try thus, Take a Potfull of *this Water*, boil it that there may Section. 1.

Chap. XIII. may remain a *slime* or *settlement*, weigh this, and do with it as with other *Silver Oar*, so will you finde what it contains.

CHAP. XIII.

How a true Lead-Grain *which is usually drawn off in the Proof, is to be made.*

Section. 1. EVERY *Assayer* hath need to have great Care of the *Lead-grain* which he may make of the Lead that he uses dayly more than one *grain*, that he may be certain, because all *Lead*, almost, doth contain *Silver*, and although the *Lead* of *Villach* is counted the best for to assay withall, yet there is but little to be found of it that is quite without *Silver*.

2. *The Lead of* Villach *not without Silver.* So then there is no grounding upon this, because unexpert *Assayers* that do run off upon the Copel four *Centners* of *Lead*, and vvhen they find no *Silver* therein, do therefore conclude that there is no *Silver* in the *Lead*, but there is need to run off so much *Lead* upon the Coppel, as much as is required to every *Assay*, and to try it more than once, and if then there is found nothing in all this, then may it be concluded, That the *Lead* holds no *Silver*, and yet one is not to rely altogether upon it,but an *Assayer* is to prove his Lead several times over and over,again: that if a piece or lump should differ one from another (because the Pieces of *Lead* are not all cast at once in the *smelting House* where it is made) that he may be certain of his *Lead*, which is of much concernment: and so you will finde that also the

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Villach-Lead doth leave a grain of *Silver* when the full weight of *Lead* is *assayed*, which *silver*-grain is to be laid upon the *Scales* with the *Assay-weight*, that it may be abated from the other *Grain* of *Silver* which came from the *Proof*-Oar. CHAP. XIV.

Further some *Assayers* are of the mind, That if there is a little *Copper* added that holds no *silver* at all, and doth cause it to go off on the *Coppel*, that then the *Lead*-grain is found the better: this is well, if one desires to try *Copper* upon Silver; and so to make the *Lead-grain*; but to *Oar-proofs*, and to other things which are not *Coppery* such a *Lead-grain* must not be used. Section. 3. *The Lead-grain with the Addition of Copper.*

Because all *Oar-Tryals* do *slack* in the proving such as are very rich of *Lead*, and yet do afford some Silver: the Opinion of some is, to take the weight of *Lead*, and a *Centner* of Earth of the Mine or common *Oar* which hath little or no *silver*, and boyl them up together, that they may turn to *slacks*, as is done with the *Oar-Tryals*; then the *slacks* will draw in part of the *Lead grain*, which is to be counted for a true *Lead-grain* for use. But I judge because the *Lead grain* is otherwise poor, that the Difference herein is not great, yet it is left to every ones pleasure to make use of his own way. 4. *To make another Lead grain.*

CHAP. XIV.

How a Slackstone *or* Copper-stone *is to be made, and to be tryed for* Silver, *and what the* Slackstone *is.*

SLACKSTONES (as the Philosophers do judg) are *Sulphur* and *Arsnick* mingled vvith a subtil Earth, and doth separate in *fusion* from the *Dross*, and doth draw the *Copper* and *Silver* to it self, demonstrated thus; The *Brimstone* in the be- 1. *What Slackstone is.*

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CHAP. XIV. beginning doth roast away, and the *Arsnick* doth *sublime* it self with a strong heat, but the Earth in which the Silver is and the Copper doth remain, which is afterwards easily brought to *flacks*, that the Metal may be separated, which otherwise could not be if the *Arsnick* had been with it, from hence may be known how to draw the *Silver* and *Copper* out of the *Slackstone*, so can it be no otherwise than to separate the *Sulphur* and *Arsnick* first from it, which is done by roasting, as may be seen in the great works of *Smelting*; thus, that the *Slackstone* in the beginning may have but small heat (and not a strong fire) so that the

2. *To separate it from* Sulphur. cold Air may easily fall upon it, and cause the venomous *Sulphur* to rise, (which doth fly from cold, and ☞ loves the heat) and so doth easily separate, which otherwise doth stay in a violent heat, and remains alwayes *Slack stone*, and is afterwards not so easily separated, yet a small heat only doth it not, therefore in *roasting*, the fire must be increased by degrees, and in the End, when the *Sulphur* is almost roasted away from the *Slack stone*, then with a strong fire the remaining *Sulphur* and *Arsnick* must be driven away, although the roast should flow with it, yet it is no hurt to it: I do write this, That it may be seen, that the *Searchers* of *Nature*, have also with Diligence searched into these things, and that *Roasting* hath had its rise from thence.

3. *Which way the Cakes are to be knock'd out.* When the *Red Slacks* or *Copper-stones* are prepared and the *Cakes* set upon one another, and you are willing to try them for *Silver*, then beat out of every *Cake* a piece, not quite in the middle nor quite at the end, which is the best for proof (because the *Silver* ☞ runs toward the Cold) so that the *stone-Cakes* are found richer at the end than in the midst:) Take all the pieces that are cut out, mingle them together, and make a proof

proof of it (this is called *Younger proof*) which you may grind very ſmall, and weigh of it a *Centner* with thy *Aſſay-weight*, and *aſſay* ſuch a *Stone* (as you have been taught above) and as hath been done with the *harſh Oars*, put preſently its due of *Lead* to it, and let it firſt *roaſt* off upon the ſame. In the end give it good heat, that the proof may be boyled up; But becauſe this Proof is of much Concernment, therefore take ſixteen weight of *Lead*, that the *Tryal* may have enough, becauſe for a Tryal it is better to have the weights of *Lead* too much than too little.

Chap. XV.

CHAP. XV.

To try Hard *Work and* Copper - *Laech upon* Silver.

Section. 1. *Two Sorts of Hard Work.*

TRY and fat *hard Work* or *Copper Laech* ſome Founders (eſpecially them of *Cuttenberg*) do uſe for an Addition to work the *ſilvery* Oars into flacks, that ſuch Addition may be rich in *Copper*, and that *freſh Cakes* may be caſt, and the *Silver* ſeparated, to which in Compariſon to common *Refining*, there belongs a particular Account and Underſtanding, for ſuch dry and fat *Hard Work* muſt be tryed for *Silver*, like unto a *Leadiſh black Copper* (which is almoſt one thing) and of which there will ſoon follow Direction.

CHAP.

CHAP. XVI.

To Assay melted Speiz, *and what it is.*

Section. 1. *What Speiz is.*

THE *Spiez* Oar is in many places (especially in *Joakim's* Valley) and is found out in melting: the Philosophers do think that it consists of *Arsnick* and *Brimstone* mingled with a subtil Earth, vvhich doth separate it self from the *flacks*, like unto the Copper *flack stones*, only in the *Spiez* Oar and the *flack stone* there is this Difference: For, as the *Brimstone* doth surpass (as abovesaid) the *Arsnick*, so in the *Spiezy* Oar the *Arsnick* surpasseth the *Brimstone*: therefore the *Speiz* is vvhiter than the *Slackstone*, and doth loose but little either in the strong, or small fire, nor by roasting; nor can it be overcome ☞ by *Lead*, but is always found again, and doth loose but little; only this is necessary to be known, that when the *Speize* is melted in the *flintish-Lead* Oar gently, and not over-heated, and doth then mingle with the *flacks* of *Iron* and (according to the manner of the City of *Goslar*) doth melt among the light Dust, so comes the *Speiz* to be lost, and none of it is found again, and the Silver enters into the *Lead*, which is caused by the *Antimony* in the *Lead-oar*, and the *red Sulphur* in the *Flints*: which are both again in the *Arsnick*.

2. *To take the* Silver *out of Speize.*

But when there is a desire to *Assay* the *Speiz* for Silver, you must grind it small, and weigh it, and with so much *Lead* (as a *flackstone* hath need of) set it on a *Test* in an *Assay oven*, and in the beginning a great *Grain* of *speiz* vvill be found svvimming upon the *Lead*, vvhich cannot be consumed by

by it, ſome *Refiners* do take this Grain with *Pincers* out of the *Lead*, and although the *ſilver* of the *ſpeiz* doth enter into the *Lead*, yet without queſtion ſuch *Grain* doth contain ſome *ſilver*: But that the full Contents thereof may be found out, Leave the *Grain* on the *Teſt*, and add to the *ſpeiz* on the *Teſt*, ſome *filings* of *Iron*, that hath no *ſilver*, and then the *ſpeiz* will be quite conſumed, and become *droſs* or *ſlacks*. CHAP. XVII

CHAP. XVII.

How Black Copper *is to be melted and caſt into* Ingots.

THERE are many ſorts of *Black Copper*, one part is very good, but others unclean and *harſh*, as *Iron-ſlacky*, *leadiſh*, *ſpeizy*, and alſo ſometimes *tinny*, according as a *Copper* Oar doth break by another *metallick* Oar, or, if any of them hath veins through the *Copper* Oars, ſuch a Metal comes to be mingled with the *Copper*, and is the worſe for it. Section. 1. *Difference of the Black Coppers.*

So then, if you will cut out ſuch *black Copper* and will caſt an *Ingot* of it, Take of the Cakes which have been made upon the *roaſt* at once into *Copper*, cut a ſmall piece of every Cake above and under, and not quite in the middle, nor at the end, according to proportion and bigneſs of the Cake; and here you muſt be careful that you do not cut a ſmall piece out of a great Cake, nor a great piece out of a ſmall Cake, becauſe one Cake contains more *ſilver* than the other, and ſo a Proof may be ſoon made falſe. 2. *How black* Copper *is to be cut out.*

When the Cakes are all cut out, then put all the pie- 3. *How the* Proof-Ingot *is to be caſt.*

CHAP. XVII ces into a *Crucible*, melt them before the Bellows together, and when the *Copper* begins to flow and drive, then ſtir it about with a dry ſplinter or ſtick, and let it ſtand a little longer, then take a clean *Ingot* rub'd with a little tallow, and caſt the *Copper* into it, all at once, that nothing remain in the *Crucible*, but ſet the *Ingot* ſmooth, that the *Copper* may be no thicker at one end than the other, becauſe where the *Ingot* doth hang, the *Copper* runs that way, and is richer there in *ſilver*, eſpecially in *rich Copper*. You muſt alſo quench in water the *caſt Ingot*, if the *Copper* hath not been *leady* or *tinny*, and with a hard *Charcoal* the tallow may be ſcoured off, and the *Ingot* cleanſed, but the *Lead* and *Coppery* caſt *Ingot* muſt be left cooling in the *Ingot*, that the *Lead* may not riſe up, ſo is the *Ingot* finiſhed, which is to be cut half-through the *Ingot*, and beat it croſs vvay, then vvith a *Hammer* and Chiſel ſtrike it into two, ſo in the breadth the goodneſs of the Copper may be ſeen, and how the *Ingot* hath been together: and one half is to be given to the Buyer, and the other to the Seller, that if there ſhould be an Error in the Proof then the *Ingot* might be aſſayed again.

Section. 4. *Difference of the Proof* Ingot.

It is alſo neceſſary to know, that if the *Copper* doth drive too long in the *Crucible*, it doth waſte and become richer in the Contents, which is eaſily to be ſeen, beſides, if the *Ingot* be *caſt* too hot, it will be in ſome places full of little holes, alſo if it is not all over ſmooth, but wrinkly and with knots, then it is caſt too cold, ſo it is not found alike in *Contents*: if any of this happens in *Caſting* by negligence, then ſuch an *Ingot* is to be done away, and the *Copper Cakes* again cut out, to caſt another *Ingot*, and thereby you will fine the right proof, and contents; becauſe if the firſt ſhould be melted and caſt again, then it muſt drive again in the *Crucible*, and the

the *Copper* would waſte more, ſo the Contents would be richer, and the *Tryal* falſe.

CHAP. XVII Section. 5. *Aſſaying the Ingot.*

If you intend to aſſay ſuch, *Caſt Copper Ingots* for *ſilver*: Cut (with a *Chiſſel*) at the end of the *Ingot* a little piece, put that away and cut another, beat it flat upon a clean Anvil, or, if tis brittle, then to ſmall bits, which you may weigh and aſſay thus: weigh of ſuch pieces equally two *Centners*, put each in a ſmall paper by it ſelf, make it ſo that it may lye flat in the papers, and not in heaps, put alſo two great well-made and well neal'd *Coppels* in the *Aſſay-oven*, in the middle under the *Muffle*, and in each ſixteen *Centners* of good *clean Lead*: but before all this, make a flame in the *Oven* with a *Copper pipe*, and the Oven and Coppel muſt be clean that no Aſhes may remain in it, make it at the beginning warm, and when it begins to glow, and when the *Lead* doth go upon the *Coppel*, and doth not leap; then put the weighed Copper upon it; make it hot again untill it begins to melt or to go *freſh*. After this open the upper *Mouth-hole*, and ſhut the lower, cover the *Oven* with a Cover, yet not quite cloſe, but that it may remain open about an inch wide, or as neceſſity doth require; Afterwards ſet behind (and upon the ſides of the *Muffle*) the little Inſtruments, ſo the Copper will ſoon begin to go, then let it have a requiſite Coldneſs (becauſe the *Copper* among other Metals (try'd for *ſilver*) can endure the moſt cold. And after it hath gone a while cold, then lay before the upper *Mouth-hole* a few live coals that do not ſparkle, or, if you do make your tryal in the *Furnace* made of *Armour-plate*, as in *Sculpture* III. *Figure* 9. then put before the upper *Ovens-mouth* the little plate full of holes, and govern the fire with ſuch live Coals on the plate with holes, or by moving the *Cover* above, that the tryal may be hotter and hotter untill the end, then take the Cover quite

CHAP. XVII Section. 6. *The Regiment of the fire.*

quite from the *Oven*, and cause the *Grain* of *Silver* to be all over bright and clean from spots, because the *Copper* Assay and government of the fire is of much concernment, and is accounted so, because it is necessary to know how to give heat and cold (as it requires) if the same be duly perform'd) but if it is not so, and that the tryal be too hot, then there will be an ounce of *Silver* less in a *Centner* of rich *Copper*, and the Contents will be found so much poorer, but because such a *Knowledg* and *Government* of the *fire* cannot be described, but is learned only out of much Experience, therefore do I rest here: But yet know thus much, that if the Proof on the *Coppel* doth grow high and clear, then it is hot, but if it doth go flat and darkish, then doth it go cold; ☞ There must in the *Copper Assay* in all Tryals, the middle way is to be observ'd, and the true contents will be found: although young *Assayers* do much esteem their own Works, and do slight knowledg of the *fire*, yet it is certain, as the *Copper* for *silver* by such means is right *assayed*, so must it be done with all other *Copper Tryals*, and he that is well acquainted with such Copper proof in the fire, he will want nothing in other Tryals, as hath been said.

7. *Of the Grain produced from the Assay.*

Thus, when the Grains of such two tryals have *twinkled*, fresh and clean, then take the *Coppel* out of the *Oven*, and take the *Grains* off, while the *Coppel* is yet hot, so they will part clean from the clear, and the Coppels which bring the yellow subtil *Littarge* alwayes vvith it. Provided it hath had its due *Heats* and *Colds* (as hath been said before) but if it hath had too great heats then there vvill be no *Littarge* and it is not good to trust to such Tryals, but vvhen the two *Assay Grains* in the drawing up of the *Scales* are of a like vveight, then is it a sign that the proof hath been well made, but if they differ, although the Tryals have been diligently per-

performed, yet there is no certainty to ground upon it, and it is better that ſuch be made anew; but forget not vvhen you do intend to dravv up the Proof vvith thy vveight, to put it in the *ſcales* vvith thy vveight *lead grain* of the *Aſſay lead*, and to beat it off from thy proof grains, although it be very ſmall. CHAP. XVII

Section. 8. *Another way to try* Copper *for* Silver.

One may as vvell lay the vveigh'd *copper* firſt upon the *coppel*, and let it glovv vvell, and aftervvards the due vveight of *Lead*, vvhich is as vvell; only the *coppel* muſt firſt be vvell vvarmed, othervviſe the *Lead* will leap upon it, and the proof become falſe, which cannot be by the former way, becauſe if the *Lead* which is ſet firſt alone upon the Coppel ſhould leap, it may then quickly be made ſtill again, if a live Coal be laid a little while on the top of it, and afterwards put the *Copper* upon it, ſo it will not hinder the Tryal.

9. *Proof* Inſtruments *to have great care of*

Further, every *Aſſayer* ought to know when the *Coppels* are not made of good *Aſhes* and well prepared, for hereby they become tender, and will rob the proof of ſome *Silver*; likewiſe, when he doth uſe a new *Aſſay-Oven*, to which he is not uſed, and doth not know well the Degrees of *fire* in it, ſo it is better that he may learn firſt to know well the nature of his *Coppel* and *Oven*, that he may truſt to it, and this may be done in the following manner: Take a *Copper Ingot*, of which a *Centner* contains about forty *Loth*, or twenty *Ounces* of *Silver* (which in many Tryals hath been found of a certain Content) and of this make one or two *Tryals* one after another, as often as you do intend to change your Inſtruments; then, if you finde the firſt contents, you are certain of your Inſtruments, and there is no fault in them.

10. *Proving of the* black & *raw* Copper

Concerning the *black-iron-ſtreamy-ſlacky* and *raw Copper* they are not to be aſſay'd like the abovenamed *good Copper* upon the Coppel, therefore when you do intend

CHAP. XVII. to try ſuch, beat them ſmall and weigh of them two equal *Centners*, put each of them in a particular clean *Teſt*, place them in an *Aſſay-Oven*, and when they are glowing through, put to every Tryal its due proportion of *Lead*, to wit, ſixteen *Centners* (like them before) and make them warm, and ſo they will begin to *ſlacke*, but you muſt not let them *ſlacke* too much, for then the *Lead* will enter into the *ſlacks*, and there vvill remain too little *Lead* with the *Copper*, and ſo cannot go clean off, but if the proofs be right boyld up, then take them out, and let them cool in the *Teſts*; afterwards ſeparate the *droſs* from it, and cauſe the *Lead* or work to go off upon the *Coppel*, as cold as can be, yet ſo as that the proofs (as hath been taught before) may not congeal too ſoon, but appear pure and bright, and hereby you will have the true Contents, becauſe ſuch *unclean coppers* when they are not boyled up at firſt, but enter *raw* upon the Coppel into the *Lead*, then they do *ſlacke* upon the Coppel and fret on it, and the proofs muſt be hotter, ſo that the true contents cannot be exactly found out.

11. *The weight of the* Coppels.

Further alſo, I cannot leave unmentioned, That the Coppels after the proving of Copper do alwayes come heavyer out of the fire, than they were ſet in at firſt, ☞ vvhich thing although it brings little profit to a Refiner to knovv; yet it is to be vvondred, vvhat the cauſe of it might be.

CHAP.

CHAP. XVIII.

To try Bell-*metal for* Silver.

BELL-*metal*, of *old broken-Bells* (vvhich is ſometimes rich in *Silver*) muſt be tryed like unto the *black raw* Copper; but becauſe of the *Tin* that is in it, it muſt be boyled up ſtronger, therefore there muſt be to ſuch Tryals, four parts more of *Lead* than to *Copper*, by which alſo the *Lead* doth looſe more: Or, weigh of ſuch *Bell-metal* only half a *Centner*, and allow to it ſo much *Lead*, as to a *Centner* of *Copper*, ſo it will *ſlack* clean, and there will remain enough of *Lead* with it, (after it is boyl'd up) to drive off in the *Coppel*. Section. 1. *Bell Metal*,

CHAP. XIX.

How old Silver-plate *or* Coyn *is to be made into* Grains.

GRAINING of *Silver* is done for the moſt part when bad, broken or other forbidden Money (*coyned* in *Hand*) that the ſame may be all melted together and afterwards to *Aſſay* it, and to fit it for better *coining*, that alſo the bad Money may be rooted out of it : this is to be done thus; When there is much of it to be *granulated*, then muſt there firſt be a furniſhing of neceſſary *Inſtruments*, *viz*. *Crucibles* and 1. *For what the* Graining *of* Silver *is profitable.*

CHAP. XIX. and *Wind-Ovens*, that one may easily *granulate* a great quantity of *Silver* in *Plate* or *coin*, and when you have all Necessaries, then set the *crucible* empty into the *wind-oven*, a good hand-breadth higher than the grate, and cover it with an *Iron*. cover, cover the *crucible* all over with coals and ashes, and upon them live coals, let the fire kindle from above downwards, then you need not fear, that it will be crack'd (as it happens sometimes when it is set in a suddain heat) and when the *crucible* hath been set thus in the fire, and that the fire hath vvell kindled downwards, so that the *crucible* is red hot all over, then uncover it, and see if it is yet vvhole, and hath no crack, vvhich is soon seen in the glovving heat, then put in the *Silver* that hath been first vveighed in the *crucible*, and cover it, put coals over it, and give it a strong heat, that the *Silver* may sink, then may you put more *Silver*, if you have it into the *crucible*, and give it fire again, that it may sink, and also follovv it vvith the *Silver*, until the *crucible* be full, vvhen that is done, then give it fire enough, so long till the *Silver* in the *crucible* begins to *drive*, and when thou seest it *drive* then throw upon the *Silver* (in the *Crucible*) coal-dust, or Ashes that the *Silver* may be covered with it all over; stirr it well about with a glowing hot *iron hook*, and afterwards with a small warm *Crucible* take the *Silver* out of the greater *Crucible*, and pour it in cold vvater.

Section. 2. *Why the Crucible so easily breaks*

3. *To* granulate *the* Silver *round.*

If you vvill have *round Grains*, then pour the *Silver* through a vvet *Broom*, but if you vvill have your *Silver hollow* and *thin* for separation then stir the vvater vvith a stick vvell about and pour the silver into the boyling vvater, so vvill it become hollovv and thin, or *granulate* it over a **Role*, (vvhich being half in and half out, the water vvill run about, so will it be *hollow*, after it is *granulated*; then pour the water off from the *Grains*, and dry them in a *Copper* bason over the fire.

* *Waltzen.*

But

But if there be many to be melted and *granulated*; the *Crucible* is to be ſet likewiſe into the *wind Oven*, and firſt kindle the *fire* by degrees, that it grow warm, that you may ſee if the *Crucible* doth remain whole, becauſe if the ſame in the firſt kindling doth remain whole, it will hold well in melting, provided the firſt be well tended, ſo that the *Crucible* may not ſtand naked, but that it may have a like heat, becauſe the place that is left naked the cold doth work upon it, and in that part doth eaſily break, therefore it is neceſſary to put the coals ſometimes down about the *Crucible* with an iron Inſtrument, that the *Crucible* may be preſerv'd, and when the *Crucible* is glowing warm and whole, then put with an iron Inſtrument (which is made purpoſely for it) the old *Silver* therein, that the *Crucible* may be heap'd full, and put the cover upon it, and afterwards coals, and give it convenient heat, and the *Silver* will eaſily ſink down, and ſtill go on in putting in *Money* ſo long till the *Crucible* be full with the melted ſtuff, and then give it a ſtrong fire or two, that it may be fully hot in the *Crucible*, and when you ſee that it doth caſt a *black Scum* upon the *Crucible* (which *ſcum* you muſt take off with a *Scummer* full of holes, and let it be cold) then ſift it through a fine *hair ſeeve*, that the *grains* of Silver which have been taken (with the *ſcummer*) out of the *Crucible* may be put to the other *Grains*; keeping the black duſt that falls through the *hair Seeve*, becauſe there is yet ſilver in it, which afterwards you may make to profit; when you have taken all the *ſcum* from the *Crucible*, then caſt again ſome clean coal-*duſt* upon it, give it fire once more, that it may be very warm, and drive it, if it be not ſo, then the contents of the grains comes not alike, and it happens ſometimes, that that which is not alike muſt be *granulated* again, which can not be done without loſs, therefore be carefull at the firſt, and

Chap. XIX. Section. 4. *How to govern the fire.*

 do not haſten too much with it, ſo when it is full hot in the *Crucible*, then may it in the ſame manner (as hath been taught above) be taken out of the *Crucible*, and be caſt through a *wet Broom* (which hath not many ſmall twigs)into the water, or, if there be much to be caſt,then have twoBrooms to caſt through, that the one after the other may be dipt into the water, this is the common way of *granulating*, and it is the beſt vvay to do it, by vvhich the *grains* have an equal content, and near finely *round*.

CHAP. XX.

To granulate *out of a* Kiln.

FURTHER,there is another way to *granulate* (novv uſed) call'd *Granulating out of the Kiln*,and is thus: Cauſe a *Kiln*

Section. 1. *The manner of performing it.*

to be made of *Potters earth*(alittle above a Span diameter within)which muſt have *Iron-hoops*, and the middle ring or hoop muſt have a long *Iron-handle*,and at the end of the handle a ring ; likewiſe the *Kiln* is to be cut out on that ſide towards the Bellows , and when there is an Intention to *granulate* in the *Kiln*, then it muſt be ſet before the mouth of ſtrong *Bellows*, and coals put in it, and after let the *Bellows* blow into it,that it may glow well ; and then the old *Silver* (with an *Iron-ladle*) muſt be put on the top of the *Coals*, and the *Bellows* muſt blow always, ſo will it melt eaſily ; and put ſtill more *ſilver*, and let it flow: do this ſo long till as much *Silver* is in the *Kiln* as it can hold : ſtir it well about, after that, Take the *Kiln* vvith the coals in it, from the *Bellows*, and take it vvith the handle upon thy arm, and the ring which is at the end of the handle in thy hand,by which you

you may govern the *Kiln*, and so *granulate* it out of the *Kiln*, through *Brooms* as hath been said before. CHAP. XX.

This is a quick way to *granulate*, but the Contents of the old *Silver* is sometimes not found alike, and it doth also waste more than by other *grainings* or *granulatings*: Now as often as there is need to melt in such a *Kiln*, it is necessary to do it alwayes well over with a good *Clay*, that may hold well in the *fire*, otherwise, when the *Metal* is warm, it may flow through it. Section. 2. *A quick way of granulating.*

It happens also often, that if a *Crucible* doth leak or or run out; and in that case sweep all clean together, put it in a Vessel and pour water on it, and that which doth swim at top, take off, and throw away, and pour other water on it, this do so long untill the water doth go clear off, then out of the Residue pick out the course sand and stones, and stamp the rest in a *Morter* and *searse* it through a hair seeve, that which doth not pass keep it, because it is good, but that which goeth through, wash that again in a long *Tub* made of *Firr*, that the residue of the good may be got out: because where much is to be *granulated* there will be sometimes some Mischance, so that a *Crucible* may run out, and cannot be rectifi'd again without loss and dammage. The following *Sculpture* is thus 3. *When the* Crucible *doth break.*

Deciphered.

1. *The* Grain *or* granulating *Kill or Kiln.*
2.2. *The* Wind-Oven *of* Potters-stuff *upon a Trevet or three-foot Frame.*
3. *Another* Wind-Oven *of* Potters-Loam *with Iron-Hoops, on a three-foot Iron-trevet or frame.*
4. *The* Crucible *in which the* Silver *is to be melted.*
5. *The* crucible *in which the melted* Metal *(that is taken out of the fire) is to be put.*
6. *The* copper-Bason *in which the* granulating *is perform'd.*

6. *The*

CHAP. XX.

7. *An* iron-roaster *on which the* Silver *is heated and roasted.*
8. *He that tends the* Grain-Kiln.
9. *The* Broom-*holder for* Granulation.
10. *The* granulating *Vessel.*
11. *The* Bellovvs *to the* Grain-Kiln.
12. *The* Instrument *used by him that tends the* Grain-Kiln *or* Furnace.

Sculpture VII.



CHAP.

CHAP. XXI.

How the grain'd *or* granulated Silver *is to be assayed for* fine Silver.

GRanulated *Silver* hath different Contents, therefore according to its contents the Addition of *Lead* must be: but that there may be a true Understanding of the difference, so the Addition of *Lead* (according to the Contents) must be taken thus, *viz.* to that vvhich contains fifteen *Loth* of *fine Silver*, the *Lead* must be 5 or 6 times the quantity, and to that vvhich is *burnt silver*, (and is 15 *Loth* and three *drams* in the *Contents*) to such there needs but four times the quantity. But if the *Grains* are from 12 to 14 *Loth*, then take to one *Mark*, ten *Marks* of *Lead*, and upon 14 *Loth Contents*, take nine quantities, from 9 unto 12 *Loth Contents*, take 16 quantities; and from one to eight *Loth-Contents*, take 18 quantities: and although upon some *Contents* there might well be one or tvvo *quantities* more, than one too little: so that the Proof may have its due of *Lead*, and if the proof is right governed there vvill be no vvant.

Section. 1. *The different Contents of* Graind Silver.

2. *The different* Quantities of Lead.

When you are ready to assay such *Grains* or *old silver*, then set first the *Coppels* into the *Oven*, and not above tvvo *silver Tryals* at a time: Let them be vvell *neale'd* and heated, and then put the vveight of the *silver* or *grains*, to two equal *marks* of thy *penny weight*, place each of them into a small *Test* or put first the prepared *Lead* for the proof upon the *Coppel*, and let it begin to vvork, and after it, also the *weighed grains*; govern the *fire* by covering the *Furnace*, as also by putting

3. *Assay* Grains.

CHAP. XXI

ting the Inſtruments under the *Muffle*, that the proof may go off alike, and pretty cool ; cauſe afterwards the *Grains* to ſhine bright, yet not over hot, that they may not bolt or fly out, elſe the proof will be falſe.

Further, know alſo, that the *Grains* which are rich in *Copper* (and can endure much cold in trying) muſt be kept coldeſt, and afterwards let it ſhine clear (if the *Contents* be truly to be found)and that which is not rich in *Copper*,with leſs coolneſs vvill leave its ſubtil *Littarge* on the *Coppel* (as hath been ſaid above.) But the *Burnt ſilver* and the very *rich Grains* cannot endure the cold becauſe it hath no *ſtreamy Copper* with it, and the proof would eaſily congeal, and if this ſhould happen there would be no Remedy afterward, but it muſt be done again, therefore ſuch proofs muſt go off a little hotter.

4. *To aſſay* rich Grains.

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5. *When the Proofs have too little Lead.*

But if it ſhould happen (by not minding it) that to one poof,there ſhould be one or two quantityes of Lead too little, then the Proof will not ſhine clearly at all ; which is eaſily to be ſeen by the *Grains*, when there are little Spots upon them : as alſo black and wrinkly, and not very clean, ſuch Tryals are falſe, and muſt be begun anew.

6. *When the Proofs do go too hot.*

Alſo it is to be noted, That if the proof do go too hot, then the *Lead* will carry more than ordinary, of *Silver* with it into the *Coppel*: and what one hath in the beginning of the proof, that he vvill finde ; only have a Care that the *Grains* (in the end) may be clean and clear, ſo you vvill finde the true Contents.

7. *To make* aſſay grains fine.

When the *Grains* are gone off clean, then they muſt be ſtruck off from the *Coppels* while they are vvarm, ſo do they go off clean from the *Clar*, but if there ſhould yet ſtick ſomething about it,then preſs the *Grains* with clean flat tongs, and the unclean will fly avvay: Further, Bruſh it vvith an hard *Bruſh*, clean off, and vvhen they are very clean, then vveigh them one againſt another

ther, if they be alike and do ſtand even at the *Globe* of the *Ballance*, then is the proof right: weigh then one grain by it ſelf, and ſee hovv many *Loths*, *Drams* and *Pence*, it hath by thy *Aſſay-weight*, that you may find by it, the true Contents, and ſee that the *Lead-grain* be alwayes abated, though it be never ſo little. CHAP. XXII

CHAP. XXII.

How coin'd Money *in great or ſmall Sorts may be Aſſayed.*

WHAT concerns good and *Groſs Money*, as *Dollers* and new *Rix Gilders*, try them thus, Take the piece you do intend to try, beat it flat at one end, upon a ſmooth clean *Anvil*, that it may be cut with ſmall Sheers uſed for *Silver*, and ſo cut it into little pieces, and weigh them according to your *Grain weight*, two, alike *Marks*, put this into a ſmall *Teſt*, and make a *Tryal*; if it be *Dollers*: put nine quantities of pure *Lead*, and to the new *Gilders*, put eight quantities, cauſe them to glow off in a reaſonable heat) and cold (as you have been before inſtructed) and ſuch proofs (when they are govern'd well in the fire) do yield a pretty deal of fine and ſubtil *Litarge* on the *Coppel*, which the unexpert *Aſſayer* knows not. Section. I. *Of* Dollers *and* rix Gilders.

It is alſo neceſſary to know, That neither theſe nor other proofs do leave any *Littarge* on the *Coppel*, if they be not done in *Coverd Ovens*, of which *Tryals* many *Refiners* do know nothing (as hath been ſaid) therefore they do ſeldom bring a *Proof* to its true contents, for they know not how they muſt order their *Coppels* according to the quantities of *Lead*, which is of no ſmall Concern, 2. *To aſſay with* coverd Aſſay ovens ☞

that

CHAP. XXII that they may not have too many nor too few *Ashes*, because, if there be too few *Ashes*, then the *Coppel* will become soft, because of the much *Lead* which they suck in, which easily doth draw the *silver* with it into the *Coppel*, so the Contents is lessened; and if there be too many *Ashes* then the *Coppel* will be too big, and take too much room in the Furnace, and are not so convenient for use.

Section. 3. *To assay single and double* Stivers.

Concerning *single* and *double Stivers*, they must be *Assay'd* in the following manner, Take two or three and cut them with *Sheers* into little pieces, and weigh two equal *Marks*, or *pieces* or *parcels* according to the *Grain-weight*, and take great care that you have some of the out-side for the *Tryal* to both alike, because the proof ☞ that hath most of the out-side will be found richer in the Contents than the other that hath not so much of the outside.

4. *The* Lead quantity.

Put to each *Mark* or *Proof* eighteen *Quantities* of pure *Lead*, cause them to go off pretty cool, and at last to shine clear, which then also doth leave subtil *Littarge* upon the *Coppel*, yet not so much as of the *Dollers*; then if the *Grains* are of an equal weight, the Proof is right, draw one of the two up, with the *Grain-weight*, and as many *Loths* and *Grains* as you do find, so much is there Content in a *Mark* of *fine silver*.

5. *To Assay Pence.*

Upon *white Pence*, *Reinish* and other *Pence* the proof is thus; Take twelve of them, and cut of each of them a bit or two for a *Tryal*, only take notice that you do take of such *Pence*, some *bit* where it is thick, and of some where they are thin, that to each *Tryal* there may be some of the thin and some of the thick *Bits*: add to each *Tryal* eighteen *Qantities* of pure *Lead*, and cause them to go at first fine and cool; and lastly, to shine bright, so will the *Grains* be alike; but, if in the one Proof there be much of the *thin*, and in the other much of the

thick

thick Pence ſhould come, then the *Grains* would not be alike, but oft times the proof in which much of the thin *Penny* did come, that fine *Grain* will be almoſt two *Grains* more; and the other ſo much leſs in which moſt of the thick did come.

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This is not much minded by ſome *Refiners*, but when their *Grains* do differ, then they do take the middle of it, but it is better the proof be right and that by diligence, the proofs may come out alike; becauſe the ſmall Money by boiling white doth differ in the Contents, ſo is the proof now adays better to be found than to melt a *Mark* of the Money in a *Crucible*, and ſo ſoon as it begins to drive, to caſt it into an *Ingot*, and then to make a tryal of it ſo (without queſtion) the true Contents will be found, and agree with the other proof made of the thin and thick *Bits*.

Section. 6. *To finde the true Proof in* ſmall Money.

I muſt mention alſo, that ſome *Refiners* and *Aſſayers* are about to prove *Coyn'd Money* with the *Low Dutch Penny weight* (which is not amiſs) becauſe the Contents do agree with the *Grain-weight*; as for *Example*, Suppoſe you have aſſayed new *Gilders*, according to the *Grain-weight*, and have found that the *Mark* doth contain fourteen *Loth* and ſixteen *Grains*, but according to the *Low Duch Penny weight*, twelve pence and four *grains*, theſe twelve *pence* and four *grains* make juſt ſo much as 14 *Loth*, and 16 *Grains*, and ſo both of theſe are of one *Content*, yet of two Denominations.

If it ſhould happen that an *Aſſayer* ſhould be in ſuch a place where he hath no more then one *Centner-weight*, nor could have any more, and there ſhould come before him *Grains* of *coyn'd Money*, or a *Lump* of *Silver* to try, how much a *Mark* of the ſame doth contain (of *Loths*, *Drams* and *Pence*, or of *Loths* and *Grains*) of *fine Silver*, he muſt take out of the *Centner-weight* ſixteen pound, and let them be a

7. *To Aſſay the* Silver, *according to the Common* Centner *weights.*

A loth is Half an ounce.

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Mark or fixteen *Loths*, the eight *Pound*, eight *Loths*; the four *Pound*, four *Loths*; the two *Pound*, two *Loths*, and one *Pound*, one *Loths*; after that, the fixteen *Loths* two drams; the eight *Loth* one dram, the four *Loths*, two *Peny-weight*: the two *Loths*, one *Peny*: and one *Loth*, a *Heller* or *Half-penny*.

If he hath then affayed a piece of *Silver* according to fuch weights, then may he find the *Contents* eafily upon *Loths*, *Drams* or *Pence*, but concerning new *Gilders*, which commonly do hold fourteen *Loths* fixteen *Grains*, they will hold in fuch a *peny-weight* fourteen pound, and 28 *Loths*, or a little more (which would be according to the above-named Directions) alfo fourteen *Loths*, three *Drams*, two *Pence*, and almoft half an *Heller* or *half-penny*, do carry 14 *Loths* and 16 *grains*.

Section. 8. *To affay the Centners upon Grains.*

In like manner one may for *Gold* take to 24 *Carats* 16 pounds of the *Centner-weight*, and *affay* the *Gold* according to it, but it is better if an *Affayer* hath by hand the *Affay-weight*, already parted to make ufe of the fame, becaufe to mind this doth require an expert *Affayer*, for an unexpert one will eafily err.

CHAP. XXIII.

How Burnt filver Pieces *and* Plates *are to be cut out*.

1. Burnt filver *Pletes*.

IF you will cut-out a piece of *burnt Silver*, then firft cut a piece out at the top, with a fmall half-round *Chiffel*, not quite in the middle, nor quite at the end, then turn that piece of *Silver*, and cut in like manner a piece out of the bottom, that it may not be all from one fide, but oppofite to the piece that was cut at the top of the other fide, that is to be cut on the back fide.

But

But concerning Plates,cut them out at one ſide above, and the other below, and weigh of each half a *Mark* for a proof, put them together in the Proof-*Scales*, that is into one *Scale*, and into the other put the whole *Mark*, oppoſite into the other *Scale*, if it be not juſt alike, as it ſhould be, then make it ſo, that the *Scales* may ſtand equal (and aſſay as you have been taught). CHAP. XXIV Section. 2. Plates.

Clear Silver may alſo be cut out alſo above and below in like manner for to be aſſay'd; and ſo the *Contents* will alwayes be found juſt when the Proofs have been well made. *Blink* Silver

CHAP. XXIV.

How Silver Touch-Needles *are to be made.*

THE *ſilver Touch-Needles* (which are alſo called *Proof-Needles*) they are generally made and uſed by all *Refiners* and *Guardians*, and they that deal in *Silver*: by which *Touch* all *Silver-Contents* may very nearly be known: Now to make ſuch it is very neceſſary to have weights that are a pretty deal bigger than common *Aſſay-Weights*: And then take good *fine Silver*, and of it make the firſt *Needle*, (and make a *Mark* on it) *viz.* 16 *Loth* of *fine*: And to the Second *Needle*, take 15 *Loth* of *fine Silver*, and one *Loth* of *fine Copper*: and Section. 1. 2. *To make them.*

To

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	Third	14		2	
	Fourth	13		3	
	Fifth	12		4	
	Sixth	11		5	
	Seventh	10		6	
	Eighth	9		7	
To the	Ninth	8	Loth of *fine Silver* and	8	Loths of *Copper.*
	Tenth	7		9	
	Eleventh	6		10	
	Twelveth	5		11	
	Thirtenth	4		12	
	Fourteenth	3		13	
	Fifteenth	2		14	
	Sixteenth	1		15	

Section. 3. *To try them*

When you have weighed all these, then put every Needle's proportion into a *Crucible*, and do not let it *drive* much, for thereby the *Needles* may prove false: but so soon as the *Silver* and *Copper* in the *Crucible* begins to *drive* then stir it with a dry Splinter (or stick) and cast each proportion into a small *Ingot*, out of which the *Needles* are to be made, which you may shape as you please, and put a *mark* or *distinction* on each *Needle*, according to the Contents of each, thereby to see how many *loths* of fine *Silver* a *Mark* doth contain, that you may not be deceived by the *Touch*, but thereby make a right Judgment.

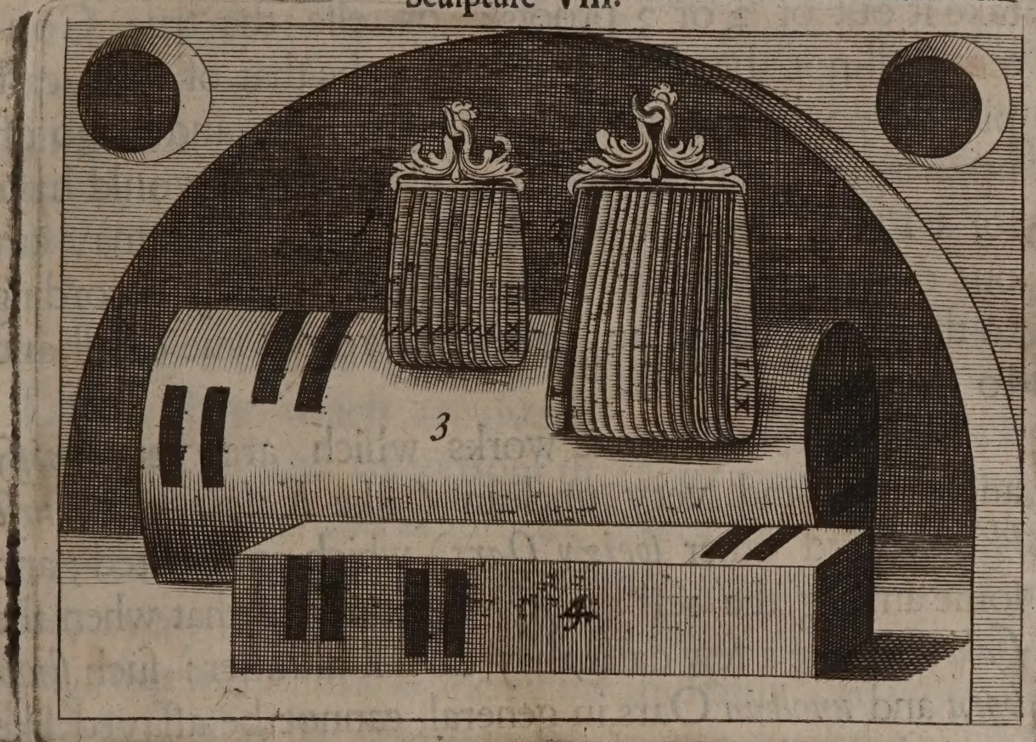
4. *Needles half Loth.*

Some do part and divide the *Needles* into two *half-loths*, which is left to every ones Freedom, and there is enough in it, where the *Touch* may not be certainly known by the *loth*, Now when thou dost intend to use the *Needles*, then upon the *Silver* which thou hast made, scrape a fine *shining stroak*, and also make another *stroak* on the *Needle* by it, and see which stroak on the *Needle* is most like the *Silver-stroke*, and so you will see by

them

them how much the *Silver* doth contain: and that the form of the *Touch - Needles* may be ſeen, this following *Sculpture* doth repreſent. Chap. XXV.

Sculpture VIII.



Deciphered.

1. 2. *The* Touch-Needles.
3. 4. *The* Ingots *to be compared with the* Touch-needles.

CHAP. XXV.

How Mettals *that are* melted *muſt be cut out, and aſſayed for* Silver.

Section. 1. *Clean work.*

OF wrought (*lead* which is *Caſt* in melting of the *ſilver Oars*) ſome are *clean* and *pure*, and others are *foul* and *unclean*; the *Clean* which come from the mild and good *Oars*, them, you may by themſelves prove like unto *Lead*, and take a Proof out of it, when 'tis going to melt, and weigh

CHAP. XXV. of it at least a *Centner*, or else when the work is cast forth, as much as it doth weigh is to be cut and assayed together: And keep this Order, that always of the whole that is *cast*, a special proof may be made, and to take it out of 2 or 3 proofs: or else the true Content will not be found, except it be that of each cast piece the whole quantity be weighed in, and to go off upon a great *Coppel* altogether; but if you would have for a Proof some cut out of the *Cakes*, you may cut out of each (especially if the Work be rich) according to the bigness above and below, to weigh some of all, and to prove it.

Section. 2. *Unclean work.* There are also some works which are very *missy* and *speizy* and very unclean (like *Kobolt* and *course Wismet* and other *speizy Oars*) which are melted; and some among the rest are so very unclean that when the *Cakes* do lye a few daies, they do fall asunder: such *stubborn* and *unclean* Oars, in general, cannot be assayed like unto the *good*; but when such Work hath been weighed, then cut or beat out of every *Cake* a piece, and weigh it so unclean as it is, *viz.* of every cut, and assay as followeth: Take of the work as much as it is in weight, put it on the *Test* in the *Assay-oven*, cause it to slack, that the Fury and wildness may be consumed, let it cool and knock it off, and cause it to go clear off from the *Coppel*, but if it be not *slacked* at first, but set raw upon the *Coppel*, then it will work upon the *Coppel*, and will not go clean off, as is shewn.

3. *Another Custom among Assayers.* Some *Assayers* do use to take the Content of such unclean work, and cause it to go together in a great *Assay-Test* or *Iron-Kiln*, and cast it forth, and then weigh of it for a Tryal; which is not right (although they do think they shall obtain the true Contents) because by this running together the Contents comes finer, and the proof is made richer, therefore the abovesaid way is much better, by which the true *Contents* is found. But

But when an *unclean Work* is put upon the *Coppel*, then to imagine (when a work of it ſelf will not go off that to add ſome other clean *Lead*, and to help it that way, that it may go off pure) is vain. For this cannot be a certain way of their Proofs, nor are you to truſt to the ſame: Becauſe in the *Work-houſes* the *Lead* is not altogether without *Silver*, ſo the *Silver* is found in the *lead* that is added (as little as it is in the other Contents) which becomes ſo much richer.

CHAP. XXVI. Section. 4. *When there is lead added to the work Tryal.*

Likewiſe as it hath been ſaid, of *caſting* and *working*, how they are to be tryed, ſo it muſt be done with *hearth* Tryals, they which are overlaid with *Silver* and rich-wrought *Lead*, and taken from the *Hearths*, let it be good, or unclean, only that at leaſt, the half of the whole weight may be weighed and tryed; ſo will you finde the *fine Silver* very near, yet not altogether fully; becauſe the unclean that was at firſt in the Work, and hath been weighed with it (before the *Harth*-proof was taken off the work) when it is in driving was diſſolved and taken off; as alſo ſometimes the Proof is taken off too hot, and ſometimes too cold, by this may every *Aſſayer* underſtand the *Contents*: and which (although, as hath been ſaid, in compariſon of the Silver that is brought forth) is not much out of the way.

5. *Harth tryals.*

CHAP. XXVI.

How Tin *is to be aſſayed for* Silver.

TIN among the reſt of *Metals* doth enter moſt freely into *Lead*, but the ſtrength of the fire will not permit it to remain therewith, becauſe as ſoon as there comes great heat to it, then doth it go again, and riſe upon the *Lead*, and becomes altogether

Section. 1.

CHAP. XXVI. together *stubborn*, so that with no force of fire, besides other help, can it be brought to a true *Up-boyling* upon the *Test*, because the *Tin* doth oft times contain much *Silver*, and the *Tryal* of it is very necessary: Therefore was I the more willing to instruct young *Assayers* of the Tryal of it, which is done thus: Weigh two equal *half Centners* of the *Tin*, and to each *half Centner*, a *Centner* of good sound *Copper*, and sixteen quantities of pure *Lead*, put each *half Centner* with its *Copper* and *Lead* upon a *Test*, each by themselves: Begin first with a slow *heat*, and when it begins to drive upon the *Test*, it will begin to rise, then let it go very cool, and take two *Centners* off the abovesaid *Lead-glass* put it also to it, upon the *Test*, and the *Lead-glass* will cover it all, and will not suffer the *Tin* to rise so much: and when you have let it go *cool* so long (till the risen *Tin* upon the *Test* doth no more look bright, but black and dark) then give it again as much Heat as you can, and boyl it up (as you do an unflowing *harsh Oar*) and when it hath *flack'd* well, then stir it with an hot *Iron-hook*, let it stand a while longer, untill it be boyl'd up very clean, then take it out of the *Oven*, suffer it to cool, beat the *flacks* off from the work or *Lead*, and let it go off upon a *Coppel*: if then the *Tin* doth hold *Silver*, there will remain a *grain* upon the *Coppel*, draw it up, and you will finde the *Contents*.

2. *The Lead-grain to this Tryal.* To such a Proof must you make a *Lead - Grain* on purpose, thus; Take a *Centner* of the *Copper* of which you did add to the Proof, cause it diligently to go off upon the *Coppels* with the *Lead* quantity: and keep the *Grain* of *Silver* that comes from it which (in the drawing up of the Proof-*Grain* all times to the Weight) is to be laid and abated, else one cannot be certain of the Contents: and after this manner in *Tin* the right Contents is to be found.

Some

Some *Assayers* are of another Opinion, to beat the *Tin* thin, and weigh of it two *half Centners*, and put every one upon a *Test* by it self in the *Assay-oven*, give it a gentle heat that the *Tin* may be wasted into *Ashes*; and into the same *Ashes* (yet every one apart) they put 16 *Centners* of *Lead* and two *Centners* of the *Flus* upon a *Test*, and boil it up like unto an *Hard-flowing Oar*, and let it go off upon the *Coppel*, this proof is also right, but it requires a little more time than the former, although the *Tin* doth also rise upon the *Plate* (yet it may easily (by governing of the fire, when it hath first cooled and afterwards very hot) be forc'd to *slack* cleanly. CHAP. XXVII. Section. 3. *Another way to prove the* Tin.

CHAP. XXVII.

How to separate Iron *and* Steel *from* Silver.

ALSO there is found sometimes *Iron* very rich in *Silver*, the reason is, because the *Hammer-smiths* do not mind the small contents in it, also they do not know that it contains any *Silver*, and so, that *Silver* in melting cometh among the *Iron*: to prove this, that the certain contents of the *Silver* may be given in: File the *Iron* very small (which you do intend to assay) weigh of it half a *Centner*, and add to it a *Centner* of *yellow Brimstone*, and let it go off mingled well together and set it in a gentle heat, that only the Brimstone may flow and penetrate the *Iron*, and that it may be brought out of its substance, and let the *Iron* cool again in the *Test*, grind it again upon a Stone or *Iron*, and mingle two *Centners* of *Flus*, or *Lead-glass* among it; and add to it twelve *Centners* of *Lead*, cause it to boyl up (as you are wont to do, with a hard flow- Section. 1. 2. *With Brimstone.*

CHAP. XXVII. ing OAR) and in the end the work that cometh off, let it go off upon the *Coppel*, and you will find the *Contents* of the *Silver*.

3. *With* Antimony. Some *Assayers* do use to prove *Iron* for *Silver* another way, namely, they weigh the *Iron* (although it be not fyled small) *viz*. half a *Centner* and put it in a Crucible, and add to it a *Centner* of *Antimony*, let them go together, then let the *Crucible* cool, and put that which did drive in the *Crucible* upon an *Assay-Test*, let it smoak away, and grind it again upon an *Iron-plate* or Stone very small; mingle it with *Flus* (with an addition of the *Lead* as hath been shewed in the proof before) then cause it to boyl up clean, and let it go off upon a Coppel, but if the *Lead* be black (because of the *Antimony*) then set it upon the *Test* alone, cause it to *slack* (as other wild unclean Work) then it will go off upon the Coppel.

4. *With* grofs-Flint. Others take small fil'd or thin beaten *Iron*, cut of it half a *Centner*, as also a *Centner* of raw *grofs-water flints*, which holdeth no *Silver* (with its due of *Lead*) mingle it together and assay it (as raw Flint is assayed upon Silver) so the *Brimstone* which is in the *Flint* will devour the *Iron*, that it will become *Slacks*, and will then go into the *Lead*, and although the *Flint* holdeth a little Silver, yet that may be abated instead of the *Lead-grain*, and this way of Assaying *Iron* for *Silver*; I have found to be most fit, and it is done with little trouble, and the contents is also found right.

5. *To separate the* Copper, Iron, *and* Silver. *Copper* and *Iron*, as also *Silver* and *Iron* love one another well, and these three Metals cannot be so separated, that a part may remain, to do any profit with: yet by a right understanding of their Nature this is possible; that from the two most constant among these three (as *silver* and *Copper*) the *Iron* may be separated (being as an unclean *Metal* to those two) also the *Copper* drofs, (which

(which is ſeparated in the Melting and doth contain *Sil-ver*) may be ſeparated; which parting is done in the following manner. CHAP. XXVII.

6. *How the* Coppery Iron *which holds* Silver *is to be made to profit.*

The *Lead*-Oar hath commonly *Antimony* with it, which (in melting as a ſoft flowing Metal) doth enter into it and devoureth it) for this end, and to prevent it, a due proportion of *Lead* muſt be added to the *Iron* in melting (as there ſhall be further Inſtruction given in the Fourth Book) for the *Lead Oar* (by Reaſon of the *Antimony* that is in it)doth work upon the *Iron*,and taketh the *Copper* and *Silver* to it ſelf,which is the Reaſon, that at ſuch places where the *Lead-Oar* is melted,the *iron rich Copper Droſs*(which doth contain ſome *Silver*) may be uſed with *Lead-oar* in ſtead of *old Iron*,which is to be put among it by degrees, and ſo the *Iron* will be conſu-ſumed,and the *Silver* and *Copper* will enter into the *Lead*, which to my mind could not be imploy'd better; but in the melting after the *Goſlariſh* manner, the *Lead* doth mingle among the duſt, whereby it doth partake of much of the uncleaneſs and wildiſh Nature which is in the Duſt and *ſlacks*, and ſo is left with it: But how the *Copper* is to be ſeparated from the Lead will follow hereafter.

7. Iron-ſtone *that contains* Silver.

And in this manner the *Iron-ſtone* (that contains *Sil-ver* may be made to enter into the *Lead-Oar*,that it may take the *Silver* out of it, which cannot be done better; and this I was willing to impart for the better inſtructing of them, that Aſſay *Iron* and ſuch melting works.

CHAP.

CHAP. XXVIII.

How Blick *or* white Silver *is to be burnt clean, and how the* Teſts *for it are to be made right.*

Section. 1. *Deft or neat*

SILVER-burning is to burn *Silver* pure and *clean* and *deft* upon a *Teſt*, and this is to be done to the Blink Silver (which is not yet clean enough) by two ways; one way under the wood, before the *Bellows*) the other under the *Muffle*, and is only done with *Coales*.

But I intend to write firſt of the *Teſts* in which the *Silver* is to be burnt clean; they are to be made and

2. *To prepare the* Teſts.

prepared thus, Take Aſhes from which *Lees* hath been made, which are not ſharp or ſalt: waſh them and let them be dry, and keep them for your uſe, and when you do intend to make a *Teſt*, firſt get an earthen unglazed *teſt* ſuch as the *Potters* uſe to make in their frames, and ſo large as thou wouldſt have them, pour water in it, and make it wet all over, that the *Aſhes* may ſtick the better, then put ſome *Aſhes* into it, which muſt firſt be moiſtned like unto the *Copel-Aſhes*, put it two fingers high in the *Teſt*, preſs it together with a wooden *Peſtel*, which hath about eight Angles: then put more *Aſhes* after it, preſs them alſo down, do it ſo long till the *Teſt* be full, then ſtroke off the ſuperfluous *Aſhes* with an *Iron* made on purpoſe from the *teſt*, and turn it about the Brim (with a round wooden *Ball*) ſo as the *Aſhes* may lye ſmooth doon upon the *teſt*, afterwards cut it, with a round ſharp *bent Iron*, according to the bigneſs of the *Silver* that is to be burnt upon it, and when the *teſt* is cut out, then muſt you have a ſmall *hair Seeve*,

Seeve, and put ground *Bone-Aſhes* in it, and ſwigle or ſtrew it over the *teſt*, that it may be white all over, and then turn the *Ball* over it, that it may lye ſmooth upon the *teſt*, ſo is the *teſt* ready. CHAP. XXVIII.

When you intend to uſe ſuch *teſt*, and to burn in it, then firſt make a Small-coal fire upon it, that it may be dry, then ſet it before the *Bellows* very even, ſo that the *Bellows* may blow juſt into it, which is to be known thus, hold a *ſhovel* over the *teſt*, aud if the blowing of the *Bellows* do go off from the *ſhovel* and blows off all the *Aſhes* and *duſt* out of the *teſt*, it doth ſtand right; and then beat the piece of *Blink-ſilver* into *bits*, but firſt put a little ſtraw into the *teſt*, and the *bits* of *ſilver* upon it; Give it fire and coals that the *teſt* and the *ſilver* may be well covered, then begin to *blow*, ſo the *ſilver* will melt eaſily, and begin to drive, then put away with an *iron-hook* all the *Coals* from the *ſilver*, and ſtroak the *ſilver* alſo clean off, yet ſo that nothing may be loſt, then lay ſplit *wood*, or other wood for *fire*, and fit for the purpoſe, and cauſe the *Bellows* to blow under the Wood upon the *ſilver*, ſo the *ſilver* will begin to drive under the wood, and that *lead* which did remain among the *ſilver* will be drawn into the *teſt*: only conſider when ſuch ſplit wood is burnt upon the *teſt*, then put more wood by or upon it, that ſtill the *ſilver* may be burnt with a freſh flame, and ſo will it be ſooner clean, while the *ſilver* doth yet go upon the *teſt*, and it muſt be ſtirred about with a round bowed *Iron-hook*, and made glowing hot, whereby the *ſilver* may be clean, or elſe it will retain ſome *lead* underneath.

3. *The manner of this* Burning.

4. *Wood for the* burning *of* Silver.

But that the *Silver* may not be Burnt ſo much, but may have a right and true content, namely, fifteen loth, and three drams, (which commonly the burnt Silver is to have) then you may in the mean time once or twice, with a well *pointed Iron*, (thruſt a little into the Silver) and

5. *The content of* burnt Silver.

CHAP. XXVIII. and take a proof out (which will hang easily about it) then beat it off, and see if it hath much *yellow Litharge*, or beat it upon an *Anvile*, and if it be Deft, then the *Silver* is well burned, if not put the proof in again, and let the *Silver* drive longer upon the *Test*, until you do find the proof upon the *Iron*, *white* and *deft*, but the Silver upon the *Test* cannot be overdone, because the Test grows soft from superfluous heat, and take more *Silver* to it than it ought; all which is well to be observed, and diligent *exercitation* or use is needful, if one will burn *blinck Silver* upon a certain content.

6. *How the* Silver *doth cool.* And if by negligence, the Silver (before it is done) doth become cool, put again Coals upon it, begin it again and burn it that it may be right, for the hard *burnt Silver* do (in *Coyning*) hurt: of which afterwards a great dammage will follow.

7. Silvers *that are not* burnt *too high.* Some of the *Refiners* in the burning of *Silver* do put upon every *Mark* of Silver a half *Loth* or *Dram* of good *Copper* that the Silver may not come too high, but upon their just content, not that it remaineth with the Silver, but because it goes together with the *Lead* in the *Test*, that the same *burnt Silver* (as we have heard) may not become of such a high content; this is a good intention in such places, where the *Silver* for Payment upon a certain content are given in, and, without proving, accepted, and there reasonable dilligence in burning may be so observed, that none of the parts may be wronged and hurt.

8. Coppery Blinck Silvers. Whole *Coppery blinck Silvers*, such as they make in the *Refining* Houses, may be burnt very Deft, but they will remain too light on the Content, to the same must be put a little *Lead*, (as much as it will permit) as sometimes likewise may be done to the Silvers which are melted of *speizy* and *Cobolt Oars* for their Wildness and uncleanness sake.

Now

Now when the Burning is finiſhed, and the *Silver* taken out of the *Teſt*, then is it to be fully quenched, whereby the *Aſhes* will fall eaſily away, which ſtick about it, and the reſt of the *Aſhes* muſt be taken away cleanly, with a ſtrong *Bruſh*, and let the *Silver* be dry, and when the *Thornels* (if there be any) and the Silver hath taken hold on the Aſhes, they muſt be beaten down with a Hammer, that the piece on all ſides may be ſmooth.

Chap. XXVIII.

9. *When the* Silver *burning is* finiſhed.

But that the Reader may have a larger underſtanding of the Silver Burning, *alſo how the* Furnace, *and* Teſt, *with all other things appertaining to them, are to be formed, is clearly to be ſeen by the following* Sculpture, *which is thus*

Deciphered.

1. *The Burning* Furnace.
2. *The* Teſt *which is put into it.*
3. *How the* Silver *is burnt on the* Teſt.
4. *The* Bellows *blowing.*
5. *The* Iron-plates Luted *over with Clay and uſed againſt the heat.*
6. *A* Fork *and* Hook *to ſtir the Melted ſtuff or Metals, as alſo for* Iron-proofs.
7. *An un-uſed or unwarmed* Teſt.
8. *A* Teſt *that is in warming.*
9. *A* Roaſter *or Iron, on which the burnt* Silver *is made dry.*
10. *The* Water-Tub *over which the burnt Metals is bruſht and cleanſed.*
11. *The* Ball *and* Peſtle *for making* Teſts.
12. *The* Block *upon which* Silver *is beaten with an* Hammer.
13. *The* ſplit-wood *for the* Silver *burning.*
14. *A* Teſt *that hath been uſed and Broken.*

15. *A*

CHAP. XXVIII.

15. *A three footed stool for several uses.*

16. *A* Tankard *to put Water, into* Fig. 11.

Sculpture. IX.



CHAP.

CHAP. XXIX.

How to burn Silver *under the* Muffle.

BURNING of *Silver* which principally is uſed in *lower Saxony*) requireth a ſingular and better Diligence than the *Common ſilver burning*, and alſo particular *Teſts* and *Muffles*: The *Teſts* you muſt make thus: Let the prepared *Hoops* be of *Iron*, of the bigneſs as you intend to burn a great or ſmall piece of *ſilver*, they muſt be high of a hand ſquare, but at the top a little wider than at the Bottom, in one of them put in the prepared *Teſt-Aſhes*, and fill it to the *top*, ſtill beating down gently (with a broad Hammer) the *Aſhes* about the *Brim*; and ſo further and further till you have beaten down all the *Aſhes* that are left, or are too much upon the *Teſt*, ſtroak them off with an *Iron*, and then overturn the *Rings* and *teſt* alike upon a little *Aſhes*, which is to be laid under; then take them with your hand out of the *teſt*, till it is half empty, and make the *Aſhes* ſmall again with your hands, then preſs the *teſt* full again with a heap beating it down alſo with the *Hammer*, as is before directed, and the reſt of the *Aſhes* alſo ſtroak off with an *Iron*, then turn the *teſt* again, and make the *Aſhes* ſmooth with the *Ball*, then the *teſt* is prepared: Now the *teſts* after this manner prepared are much better and ſtronger than they which are beaten into the *teſts*.

Section 1.

Teſts *to be made with with Iron rings.*

Concerning the *Muffles* which pertain to this *Silver-burning*, they are to be made over little round ſticks after the bigneſs of the upper part of the *teſt*, and are to be cut out in the like form with the *teſts*; and other

2. *The* Muffles *for* Silver *burning.*

CHAP. XXIX. pertaining Inftruments which the *Sculpture* following will fhew.

If now you will burn *Silver*, then put the Teft with the *Ring* between four fquare burnt Stones in Sand or *Ashes*, as deep that the Sand may be even with the *teft* above, in an *Oven* for it prepared, in which feveral *tefts* may be put together, and fuch *Wind-Ovens* muft have alwayes one *Wind-hole*, which may drive two *Ovens*, efpecially in fuch places wherein many pieces of *Silver* come together, and once in one day are to be burnt.

Afterwards put the *Muffle* on the *teft*, which is made after its bignefs, and a *burnt ftone* on the top, that nothing may fall upon the Silver, put coals upon and under the *Muffle*, and about and upon the *teft*, and when the *teft* is grown warm then put in the beaten *filver*, and let it begin to work, but if you would have it foon melted, then you may blow it with Hand-bellows, through the *Mouth-hole* under the *Muffle*, and then it quickly goeth, and when it is melted take away the Coals again, and let it go alfo under ths *Muffle*, ftir it once or thrice with the *Iron*, as you have done in the other, then it will go upon the *teft*, under the *Muffle*, all off: (juft as the Silvers upon the *Coppels.*) With this burning of *Silver* both great and fmall pieces may be burnt, as with the *Bellows*, and without lofs or any great damage upon the *Content*.

Section. 3. *A clean filver burning*

After this manner, I have feen at *Goflar* in the Work-houfe (when it was kept) upon one *Teft* on one piece near one Hundred mark of *Silver* burning: If now you will (while the Silver goeth) take out with an *Iron* one or two provings (as is done in the *Silver*-burning before) you may do it (and it is not to be defpifed) but who in this ART is converfant, the fame needeth not fo many provings, but he knoweth it upon fight, when it hath enough.

Now

Now when the Silver under the *Muffle* is burnt clear and begins to ſtay, one may let water run upon it in a *Copper Channel* and cool it, then with ſtrong *Tongs* take it out and purify it from the *Aſhes*, (as is above-ſaid) then the *Silver* is burnt. Chap. XXIX. Section. 4.

The *Teſts* may be kept together,becauſe they are not without *Silver*, the ſame in ſome *Mine-works* the Work-men uſe to take to themſelves, but in ſome they belong to the *Republique* : They may be made at any time to profit, and the *Silver* that is in them may be melted out,as may be ſeen in the following *ſculpture*, and is thus 5. Teſts *to be kept.*

Deciphered.

1. *The* Oven *in which the* Silver *is to be burnt.*
2. *The inſide of that* Oven.
3. *The* Wind-holes *of that* Oven *which drives the fire upwards into the Work.*
4. *The* Teſt *that is ſet into it.*
5. *The Iron Mould or* Ring *into which the* Teſts *are to be put.*
6. *The form of the* Iron-ring.
7. *The* Ring *fill'd with aſhes for making a* Teſt.
8. *A round* Muffle.
9. *A* Ball *and* Hammer *for making of* Teſts.
10. *A perſon that breaketh the* burnt Silver.
11. *Another perſon ſtanding on the back-ſide of the* Oven *who takes Care for the burning of the* ſilver.
12. *A Veſſel of water into which the* burnt ſilver *is to be caſt.*
13. *Bellows and* Inſtruments *belonging to the* Oven.

Sculpture.

CHAP. XXIX.
Section. 1.

Sculpture X.



CHAP.

CHAP. XXX.

CHAP. XXX.

How Copper is to be Assayed for fine Silver.

Section. 1. *How much* Lead *is to be added.*

IN respect it is of use to burn the *light-content silver* fine (for many times they who should do it, know not fundamentally how much *Lead* is to be added, whereby they do too much, or too little) therefore to such *light-silvers*, if the *Mark* containeth eight *Loths* of *silver*, then ten times the weight of *Lead* is to be added, and if the Silvers containeth from eight to twelve *Loths*, eight weights of *Lead*, and then from twelve to fifteen *Loth*, six weights of *Lead* must be added, but if the *burnt silvers centent* should be fifteen *Loth*, then the *Lead* may be two weight less, but if it should be wholly cleansed, then tis better one weight too much then one too little, that the *silver* may be the cleaner: And when you have put it in the *Test*, let it be warm, and add two weights of *Lead*, and when it begins to go, then draw in the *Silver* gently, and let it go together, and when the *Lead* is almost gone, then add again two weights of *Lead*, do this as long till the *Lead* is all put in; and the *Silver* becomes clean, and when the *Lead* is done and singly added) there needs not so much *Lead*, as when the *Lead* is added to the *Silver* all at once: you must not force it, but do it as cool as it will permit, else the *Silver* will go more into the *Test* than otherwise; when now the *Silver* is almost *purifyed*, then gently turn it with a glowing *Hook*, least it retain a *leady lump*, or much smoak of *Lead*, but by this way it may clear it self and look pure.

But as to the *Coppery Silvers*, if they are to be burnt

Chap. XXXI.

fine upon the *Test* it cannot be done more conveniently than under the *Muffle.*

2\. *To take the* smoak *of* Lead *from* Silver.

The *Silvers* which are to be burnt pure and clean with *Lead*, do retain with them a *smoak* of *Lead*, if now one would bring it off, the same must be set upon a plain *plate*, and blow it with the *Bellows*, then they may become very clean.

CHAP. XXXI.

How Silver *is to be separated from* Tin.

Section. 1.

A Test *for it.*

MANY times it happens that in burning *Silver-Ware*, *Monys*, *Copper*, and other *Metals* melted together (of which the most part oft times is Tin) that the same cannot be made to profit, nor separated by every common *Gold-smith* and Prover, therefore let this following way be an instruction (as the most convenient) namely, Put a *test* in an *Oven*, and a *Muffle* upon it, let both first well glow, and if the burnt matter be ten pounds then add upon the *test* twenty pounds of pure *Lead* at once together, and when it begins to go, then put in it of *silvery rich* Tin half a pound, then the *Lead* will take it soon to it self, which will quickly (from the great heat) begin to ascend, and to raise it self up; let it stand a while upon it, then draw it with an *Iron Hook* clear off from the *Lead*, then add more Tin to it, let it stand its time also in it, then draw it off also, and this infunding the *Lead* and drawing away, do as long till the burnt matter do all come upon the *test*, and if the *Lead* in working becomes weak, then refresh it again with one or two pound of new *Lead*, that it may endure the longer in the heat; but if the burnt matter be *Coppery*, it is the better; if not, you must add

add somewhat of *Copper*, because it becomes more *Deft* by it, and the *Lead* doth take the *Silver* and *Gold* easi- er in than out of the stubborn Tin only. Chap. XXXI.

In this work the *Gold* and *Silver* will go into the *Lead*, and the most of the *Copper* is drawn off with the Tin; then let the *Lead* go clean off, (as the Custom is) then have you the *silver* separated from it.

2. *How to make the separated Tin profitable.*

But to bring the *Copper* and *Tin* (which is drawn off) to profit, it may be done thus; let such stuff dry, and cause it to melt in a strong Fire, and so the *Bell-caster*, or *Founder* may mingle it among their stuff and cast it together (as in *Anno* 1567. the City of *Slakenword*, in the *Bohemish* Borders was burnt down, and within the Walls of the City there remained not one House) when I my self did (after this manner) bring much burnt Metals to right, and separated the *Silver* from it, which no body else would take upon him to do.

3. *To precipitate the Silver from Tin.*

The *Philosophers* do write of *precipitating*, by which the *Silver* in common *tin* may be put down, and formed into a *Regulus*; thus, one must set the *tin* apart in a little Oven, make it very hot, and then *precipitate* it, and with such a *precipitation* the *Silver* in the *tin* will be brought down a hand square, and the same in the same deepness may be cut off, and the remaining *Tin* may be again and again and so often cut off until the *Silver* in the bottom may be brought to a *Regulus*, and then (though *tin* be with it) it will purify fully, and that which doth *precipitate* will not hurt the *tin*, but they do write nothing of it: I signify this, for the sake of such, who have a pleasure to this Art, and are willing to Exercise themselves in it, and so take it into their further Meditation, that they may have hereby a way of doing it: I for my part suppose, that because the *Gold* in the *Silver*, and the *Silver* in *Copper*; is to be *precipitated*, that likewise this *precipitation* is possible in the *tin*.

CHAP.

CHAP. XXXII.

How to drive out all sorts of Silver, *that it may be Deft, smooth and fine.*

Section. 1. BECAUSE it happens many times that *Silver* in casting together from an evil *smoak* (or when happily a little *tin* comes among it, or, that among the old *Silver* there hath been *tinny*, false and gross mixtures,) becomes hard: then is it, as follows, to be made *Deft*, again:

2. *A little* Lead *Ball.* Put the *Silver* upon a plain *Test* (which is done over with clean and fine *Clar*, blow it till the *Silver* runs and goes well, then add two or three Balls of very clean *Lead*, according to the quantity of *Silver*, blow it again until the *Silver* doth bear the *Bellows*, and becomes *Deft*; but you must (in the blowing upon the *Test*) once or tvvice (with a glovving *Iron-Hook*) stir the *Silver* that it may be *Deft* throughout, then let it cool, and put it in a Pot together as it pleaseth you, and take notice, that if somevvhat of the *Copper* be blovvn avvay, by vvhich the *silver* on the content becomes richer, then if it shall retain the Content, vvhich it had before, it must (in the casting again) be helpt by adding so much *Copper*.

3. *To* Brickle *hard burnt* Silver. But *hard burnt silver*, (or other *good silver*, which might become brickle from a leady Lump) that same Silver (if a little Lead be with it) may (in this manner upon a plain *Test*) be made Deft without any addition; except it hath too much Lead with it self, then it must be

be made upon a plain little *Test* (as above is taught) by the *Silver, burning-pure* and *Deft*. Chap. XXXIII.

Alſo there may a *Flus* be prepared to make the Silver deft, (which doth cleanſe the Metals very much:) thus, Take *ſal Alkali, Nitre, Red Argol,* and *ſalt Petre*, of one ſo much as of the other, *calcine*, and diſſolve it again in warm Water, and let it go through a *filter* and coagulate; ſo is the *Flus* prepared. Section. 4. *A Flus to brickle Silver.*

CHAP. XXXIII.

How to boyl Copper *from the* pagment *or old* Silver *in* Coined Money, *or from* thin beaten plates *of* Silver.

TAKE *ſulphur* and *vitriol* of both alike in quantity, grind them ſmall, and make them a little wet with *Vinegar* that it become as a *Pap*, mingle the *Coyn* or *old Silver* among it, then take a long *Linnen ſack*, put the *Money* with theſe additions in it, ſow the Sack on the ſides from the top to the bottom, ſo that the *Mony* may not lye too thick in it, pour Water into a pot, and hang the *Sack* in it, that it may neither touch below, nor on the ſides; boyl it well ten or twelve hours with the fire, and ſo much as the Water does waſt by boyling, you muſt add to it again with warm Water, ſo that the Pot may be always full of Water, whereby the *Copper* will be boyled out of the *Silver* or *Coyn*, and the *Silver* will remain in the *Sack*, then waſh it with warm Water and pour it together, but the Water will boyl and dry in, and the reſt melt together (with the *Flus* yyhich is uſed to *Copper Oar*)

CHAP. XXXIV. thus you have the *Copper* which hath been boyled out of the *Money*, only the *silver* by this is not altogether fine but retaineth some small quantity of *Copper* in it.

CHAP. XXXIV.

How good proof Ballances *are to be made and fitted.*

Section. 1. *An* Assayer *able to make* Ballances,

A PROVER hath not only need that he have clean and just *Ballances* for proving, but he must know also when they do fail (or else become changeable or uncertain) how to mend and help them again, so I judge it for a great piece of *Ignorance* (and it is also not well,) That some who profess themselves *Provers* of this ART, do often (when a little is amiss in the *Ballance*, or worn out, or for any other small matter) use to send to *Neurembirg* and other more remote places in *Germamany*, to mend their false *Proof-Ballances*, whereas they themseves should have so much Knowledg as to make and fit them with their *Proof-weights*, and *Proof Instruments*, so as they may be certain and sure of their *Proofs*.

2. *And how to help their Defects.*

Therefore, That a fundamental Instruction may be given, I will instruct all who do love this *Proof ART* (especially the young *Provers*) because there are not alwayes *Masters* to be had, who know right well to mannage such things: and to teach how the *Proof-Ballances* and *weights*, and other *Proof-Instruments* are to be made, and also (if it be needful) to mend and rectify them: and first I shall begin with the *Proof-Ballance*, which is to be made as followeth.

3. *The* Ballance *of the Proof-scales.*

Cause a small *Ballance* to be forged out of the blade of

of an old Sword, that it may have a little broad and thin *Tongue*, and throughout be pure and well wrought, and nothing ruff or *ſhivery* be on it; this formed *Ballance* make faſt with a little *Screw*, and file the thickeſt part, and then ſearch the middle on the ſame place, and make a little hole with a *drill* through it, and faſten a round point in it, that it may ſtand out at both ends; fit it in, with thin *bits of Braſs*, and *ſoder* it (with *Silver-ſoder*) faſt into the *Ballance*, ſo the *ſoder* will eaſily flow after the thin *Braſs*. Chap. XXXIV.

Section. 4. *Tongue.*

Out of this ſodered point are filed the little *Irons* on which the *Ballance* moves, and afterwards the little *Tongue* beaten thin upon a ſmooth *Anvil*, and glow it often in a ſmall Wood-fire, that it may not crack, then ſearch the middle of the *Tongue*, from the *Wartz* or little *Iron* ſtreight upward unto the end of the ſame (and its length is to be the ſame from the *Wartz* to the end) and mark it with a ſtroak, then cut upon the one ſide of the *Tongue* next to the ſtroak a bit of the *Iron* clean off, and on the other ſide of the *Tongue*, cut ſome alſo cloſe by the *Wartz*, that the Tongue may rowl over from one ſide to the other, then may you alſo cut off the reſt of the *Iron* on that ſide, when this is done, then glow the *Tongue* and dreſs it again ſtraight upwards, then file it (upon a ſoft piece of Wood, very ſmooth, according to your pleaſure; you may alſo pierce (or make holes) neatly in the Tongue near the *Ballance* for curioſity ſake) afterwards bend a little the two ends of the *Ballance* alike, before the *Ballance* be quite fitted, that the two ends may be of equal length, and then file the *Ballance* according to ſhape and form, as a well proportioned *proof Ballance*, and ſo make an end; but how the filing and other Work is to be performed, that cannot be written, but it requireth a dilligent exerciſe.

Wartz. *See the* Dictionary.

The

CHAP. XXXIV. The *Fork* in which the *Ballance* useth to hang, that must also in like manner be subtilly Filed, also the holes (in which the little *Wartz* come to lye) may be thin, clean and strait through it, and must be *pollisht* with a smooth little Stone, that no shivers may remain, which *Fork* must be so long as the *Tongue*, that the *Ballance* may not slide out of it.

Section. 6. *How the filed* Ballance *is to be proved.* When the *Fork* is prepared, then take the Fyled *Ballance*, and hang it in the *Fork* with the *Tongue* downwards, and see if it be alike weight on both sides, if you find that one side is heavier than the other, you must help it until it does hang even, then make it smooth and clean all over with a gentle *Fyle* or with a soft *Whetstone*, and pollish it with the hard * *Bloudstone*, (which is called *Glasscup*) when the *Ballance* is fully finished, then prove it again, that the *Fork* may hang even, and that it want nothing. But if there is no *Smith*, which can forge the *Ballance* with the little *Tongue* (because all *Smiths* cannot make it so well of one piece) then take a clean *steel Wyer*, or a *forged Iron* in the form of a of a *Ballance* without the *Tongue*) and *soder* it with *silver soder*, and fix the little *Tongue* upon it, the *Tongue* may also be *garnisht* vvith *Brass*, aftervvards File a *Ballance* for it, (as hath bin said above) but if you vvill not take the pains to *Garnish* it with *Brass*, then may you take *Gold-soder* and *soder* all vvhat is necessary about the *Ballance* very cleanly, because this *soder* vvill flovv upon the *Iron* vvithout any addition or increase, and if any thing doth break upon it, it may be neatly sodered with *Gold soder*, as experience vvill teach.

* *Hæmathite.*

7. *Golden solder.*

8. *To cause the proof* Ballance *to be* blew. ☞ The proof *scales* are used to be made *blew*, (that they may not rust so easily) and is done thus, cause a pretty thick *Iron* to be warm in the fire, but do not suffer it to be quite brown, lay the *Ballance* with one end upon it, and draw it a long as it takes colour and becomes *blew*,

which

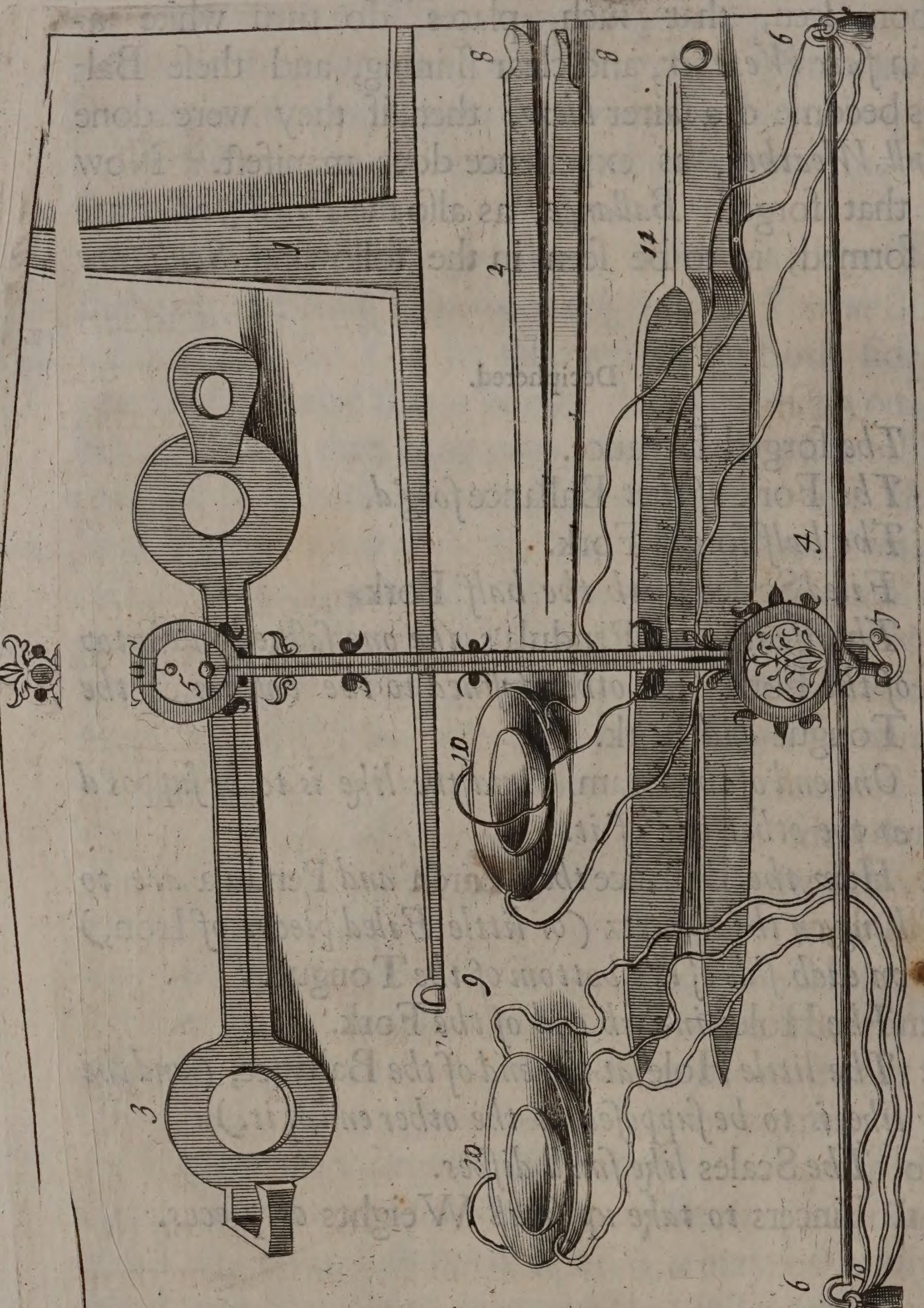
which is ſoon done, only take notice the more a place is thin, ſo much ſooner doth it heat and cool, therefore it is ſoon ſeen, that ſuch places do turn white again in *fair Weather*, and clear ſhining, and theſe Ballances become of a fairer *blew*, then if they were done in *dull Weather*, as experience does manifeſt. Now how that forged *Ballance*, as alſo the *Filed Scales* are to be formed, is to be ſeen in the following *Sculpture* thus CHAP. XXXIV.

Deciphered.

1. *The* forged Ballance.
2. *The* Fork *of that* Ballance *forg'd.*
3. *The half* forg'd Fork.
4. *Filed* Scales *with the half* Fork.
5. *The* Pearl *and* Pendula's, *the one faſtned on the top of the* Fork, *the other faſtned to the bottom of the* Tongue *and* Fork.
6. *One end of the* Beam, (*and the like is to be ſuppos'd at the other end of it.*
7. *How the* Ballance *the* Marck *and* Pendula *are to hang,on the* Wartz (*or little Filed pieces of* Iron,) *on each ſide of the bottom of the* Tongue.
8. *The* Holes *in each end of the* Fork.
9. *The little* Hole *at the end of the* Ballance, (*and the like is to be ſuppoſed at the other end of it.*)
10. *The* Scales *like ſmall diſhes.*
11. Pincers *to take up ſmall* Weights *or pieces.*

CHAP. XXXIV.

Sculpture XI.



CHAP.

CHAP. XXXV.

Of Filing or Joyning the proof Ballance or Scales.

FILING and Joyning of proof Scales is a special Science, and is the true Master-piece, which is not known to every one that can make them, and is done thus; when the proof Ballance is Filed out, (as hath been said before) then make, of Silver, two flat clean and smooth scales, and also two very thin small scales, the which are called inset scales, which altogether are to be as heavy as the Ballance, or rather a little heavier than lighter, and put fine silk Thred to them, in length of the whole Ballance, from one end to the other, such Threads are to have a neat Knot on the top, whereby the strings may hang to the ends of the Ballance, and when the strings are made fast to the scales, then weigh them one against the other, with another proof scales, and see if they do weigh alike, then hang them to the ends of the Ballance, put the inset scales therein, and hang the Assay-ballance in a Case made on purpose, and draw them up gently, if then the scales do turn on the one side; that is, when you do press the scales down on the one side, that the scales remain down, as also on the other side, and will not go back but remain standing, then the fault is in the Beam, that on the same places is fitted too high, from which the Ballance falleth on both sides, and will not stand just; if you know this, then make the Beam on both sides somewhat lower, but so that it be not higher on one side than on the other; to the rectifying of this, you should have a little smooth plate of Pear-tree,

Section. 1. To fit Scales.

2. The weight of the Scales to the Ballance.

3. The Knots.

4. When the ballance falleth.

Chap. XXXV. *tree*, upon which make a *Crofs ftroak*, and in the midft of the (*crofs* muft be a little *Hole*, and upon this lay the *filed Beam* of the *Ballance*, fo that the little *Wartz* in the little *Holes*, and the *Beam* and little *Tongue* may come to lye upon the *ftroak*, then you may foon fee how the *Beam*, the little *Tongue*, and the *Ends* are fitted, that fo you may help and fit it.

So when the little *Beam* is thus prepared, that it may ftand near the Ends, a little lower than the Line upon the little *plate*, then lay it in the *Fork*, in its place; give it the right *quicknefs* fo that it draw well and diftinctly the fmalleft of the *Weights* of the *Proof-Weights* (and not ftop in its lodge) nor have too much room (that is to fay) that the holes below of the *Fork* may not ftand too far off from the little *Wartz*, but only that one may fee through to try it.

Section. 5. *To make the* Ballance, *to ftand true.*

Now, when the *Proof-Scales* are thus made with the greateft dilligence, fee that it has its quicknefs, and does not ftand; alfo that there be no fault neither in the *Beam* or *little Wartz*, it muft ftand right both with the *fcales* and alfo without them, if it doth not this, but goes heavy on the one fide and light on the other, there is the greateft fault, which to mend many do not underftand; but thus is it to be done, help the *Ballance* above on the one end, and on the other fide on the *fcale*, (that is thus) bend the one end a little down, or a little narrower, then doth it give prefently the *Ballance* on the other fide, weight, for the length, and takes fo much from the other fide of the *fcale*, that the *Ballance* may ftand in again in the *Fork*, then try it again whether it do well either with a *Burthen* or without a *burthen*, and that it may have its right quicknefs; but if it does not fo, but goes ftill a little at one fide, then have you done too much, then help it with bowing back of the *end*, and the *fcale*; but if you have not bowed the *end* on the right fide, then the *Ballance*

lance will go more falſe, therefore you may eaſily ſee on which ſide it is to be helped with binding and fitting them, and you may alſo uſe this dilligence, that when you have bent the end on the one ſide, and that you alſo do the like on the other ſide of the *ſcale*, but make it even with *Weights*, that the Ballance may ſtand right in the *Fork*, by which you may ſee how it doth ſtand in either with Weight, or without, and then it is eaſily to be corrected. CHAP XXXV.

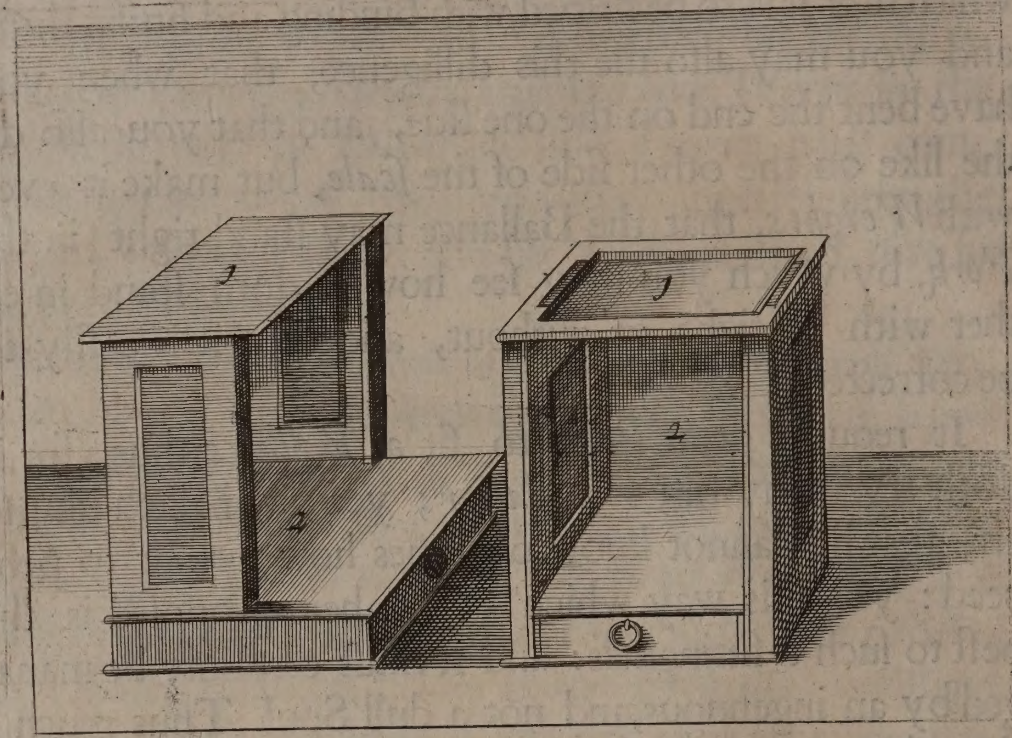
It requires great Pains to fit a *Ballance* thus, for it doth try many times a *Maſter*; yea, it maketh him ſo err, that he cannot know oft times how further to proceed: yet this way which I have here propoſed is the beſt to ſuch a fittingneſs: and it muſt certainly be managed by an ingenuous, and not a dull Soul. Thus much I thought good to ſignify, for the clearer Inſtruction, becauſe 'tis very pertinent to our preſent Diſcourſe of *Proving*, therefore I omitted it not.

Section. 6. *The Caſe for the Proof Ballance.*

And that the *Proof-Ballance* may be preſerved clean and pure from Duſt, and alſo that in time of uſe the wind may be no hindrance, but ſtand firm, therefore it is to be put in a clean and well formed *Proof-Caſe* made of *wood*, which on both ſides is to be ſet with bright and clear *Glaſs*, that the *Light* may come into it, and that all things may well be ſeen (the Form is ſhewn in the following *Sculpture*: And, for conveniency of the Sight, it were beſt to colour the Inſide of this Caſe *green*, becauſe the *Fire* is hurtful to the Eyes, and by this colour they are again quickned and refreſhed.

Or, oyld Paper.

Sculpture. XII.



Deciphered.

1. *The* Out-side *of the* Case *for the* Ballance.
2. *The* In-side *of that* Case *wherein the whole* Ballance *is to hang, and be kept from Dust.*

CHAP. XXXVI.

How Proof-Weights *are to be* made *and* divided, *and first of the* Grains Pence *and* Carrat *weights.*

Section 1. *To be made of* Silver *or* Brass.

BECAUSE both the making and parting of the *Weights* is no small thing, therefore I am obliged further to demonstrate how, and of what such are best to be made: First, it is better they be of good *Silver* than of *Brass*, for the *Silver* daubeth not, neither coloureth it so soon as *Brass* doth

doth, but remaineth all times pure and clean; if now the Silver be cast into an *Ingot*, then one may cut out four square pieces in the proportion and bigness (as every piece of Proof-weight shall weigh) heavy or light, and file all such pieces pure and clean, upon a *Whet-stone*, draw them smooth: also every one in particular (in respect of the Division) is with diligence to be put upon the *Proof-Balance*, that if it be still too heavy, it may be made lighter, and true; and so lastly, it may stand just. But some *Provers* think one should make and divide the *Proof-weights* from above, that is from the *greatest* still to the *smallest*; again, some from the *smallest* to the *greatest*; but know that it is best to be done in the following manner. CHAP. XXXVI.

If *Proof-Weights* are to be prepared anew, they must be divided from the *greatest* to the *smallest*, for this Reason, Because one may better and more easily have the just and certain weight of a *Mark*, than of one from the smallest, as from the *half-Grain* or *Heller*, and should make a Weight out of it, there the *Mark* would be either much too heavy or much too light, in which an error is easily committed, Therefore use, in such a dividing from above, a small *Grain* of *seeved* and *wash'd Copper*, by which may be seen how much must be taken away and filed off from a piece, which is yet too heavy; when now such *Proof-weight* is finished, then shall it be drawn up from below, from the smallest to the greatest with diligence upon a quick and good *Proof-Ballance*, and if there is yet any want, which cannot be great, that it may be compleatly helped. 2. *Weights of a Mark.* 3. *Proof-weights.*

Now, how the *Proof-weights*, *piece* by *piece* are to be divided, may be seen in the IX. Chapter of this *first Book*.

CHAP.

CHAP. XXXVII.

For dividing *the* Weight *of the* Centner.

Section. 1. *Carrats.*

AS the *Grain-Penny* and *Carrat Weights* may certainly be divided from the highest to the lowest, so it may be done with the *Centner-weight*, but because in the pounds there are *unequal parts*, understand it thus, The *Centner* hath a Hundred pound: the half, 50 pounds: and

2. *Unequal parts.*

the fourth part, twenty five pounds; and if one would out of it divide sixteen pounds, (which one that is not well skilled in Division may have great labour therein) then you should do thus, when you have made right the Division of the *Centner* to the *fourth part*, then weigh the *fourth part* of the *Centner* with a *proof weight* (it may be a *Centner* or *penny-weight*) and how much it weigheth, then you may make your account how much sixteen pounds shall weigh: (an example.) I put, the new divided twenty five pounds which do weigh on the *penny-weight* 13 *loths*, three drams; then I say, the twenty five pounds will weigh one *Mark*, thirteen *loths*, and three *drams*, which may weigh sixteen pounds, which amounts to nineteen *loth*, no *dram*, no *penny*, one *heller*, and do prove a little more than a fourth part of a *heller*, so much then must weigh sixteen pounds, after this weight or sixteen pounds: divide your weight with *small grain'd Copper*, (the smallest as you are informed before) and although the *Centner* had more pounds, nevertheless the *unequal* division of it may likewise be found.

Now when the *proof weight* is all perfected then draw it up likewise with dilligence from the smallest to the

greatest

greateſt, as you have done with the other, if there should be found an Errour, then mend it alſo, ſo there will be ſmall Difference, and the *Centner* will remain in the deſired *Weight*. CHAP. XXXVII

But that you may be ſure whether the *Proof-weights* be right and juſt, ſet them aſide, and make one *Proof-weight* more, as heavy as this, then put the *made weights* which pertain to a *Proof-weight* altogether in a quick *Proof-Ballance*, and weigh them one againſt the other, and if they ſtand even together, then you have made them right; if not, and that thou findeſt them not alike, then look where the Error is, and mend it, for, whoever will be ſure of his Weights, muſt not think much of this Labor. Section. 3. *Whether the* Proof-weights *are made right.*

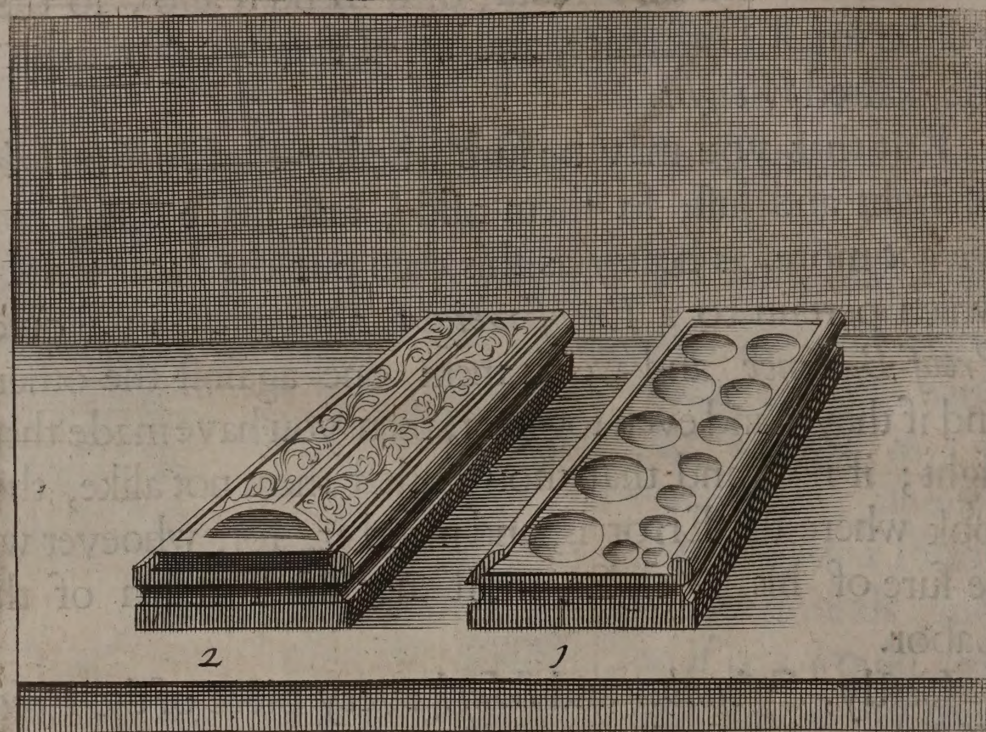
Laſtly, *Number* and *Mark* every piece of the *Proof-Weight* with a ſmall *iron* or *ſteel Punch*, how much each piece doth weigh, by which it may be known: (but the marking muſt be done after its made ſmooth on a *Whet-ſtone* whereby the Shivers which it had from the *Stamp* may be made ſmooth again) and lay them into a little clean *Box*, made on purpoſe of wood (the form of which is to be ſeen in the following *Sculpture*) in which there muſt be as many little round or ſquare *Holes*, as there are weights, then ſhut the ſides that it may be kept from *Duſt*, and that the Weights may remain clean and pure. The *Sculpture* is thus 4.

Deciphered.

1. *The little* Caſe for Weights *opened*.
2. *The ſame* Caſe ſhut.

CHAP. XXXVII

Sculpture XIII.



Thus much I was willing to signify and write con-
5. cerning the *Proving of Silver Oars*, and what appertaineth to them; and though it had seemed needful to Instruct, How such and every particular *Oar* according to their Natures and Properties, should be melted and made to more Advantage in the great Fires of Furnaces and Smelting works: yet because, in this *Treatise*, I have only purposed to write of Proofs in *Small Fires*, and lesser Ovens, and because these now mentioned works are almost common in the Smelting and great Mine-works: Therefore I am willing to let it rest here; yet some *great Works* and *Meltings*, I have mentioned (in this and other Following Books) because thy are not so common, and meerly for the Instruction of other *Assayers*.

The End of the first Book.

OF

Golden OARS.

BOOK II.

Cap. I.

CHAP. I.

THIS *Second BOOK* describeth how *Gold oars* are to be known, and how to *Roast Boil* and *Prove* them; also of *Washing*, *Purifying* and *Quickning* the *Gold Wash-works*: and further, how *Touch-Needles* are to be made, and to *Divide* the *Gold-weights*; also to distill *Aqua Fortis*, and to *rectify* it: also how *Silver* and *Gold* are to be parted by *Aqua Fortis* and by *Fusion*; and to make the *Gold deft* to *cement* it, and give it an *high Colour*, and how it must be cast through *Antimony*, and be brought to its *hight* with the *Ovens*, *glasses* and *Instruments* which are used to all these. Section. 1.

The Knowledge of *Silver-Oars* having been now treated of; We proceed to the *Gold Oars*, (although they are not found in so many Kinds and Colors) which must after their external Modes be known also, together with their *proving* and *ordering* of them. But they have this Condition attends them, (as Experience hath taught me) That no *Oar* hath Gold only of it self, without other *incorporated Metals*) unless it be apparent 2. *To know Gold Oars.* *No oar by it self Gold.*

Cap.I. Section. parent and seen, how small soever it be intermixed with them, and the same *Gold*, which is thus to be found in these Oars is not wholly pure and clean, but commonly *Silvery*, although one more than the other.

4. *Gold in Horn Oar.* Now, the *fair Gold* that is found thus *Intermixed* or commonly standing in a *whitish Flint*, and sometime in a blew and yellow *Horn-stone*, and also in a *Blew shiffer* streamy and yellow iron, but very small and flaming with *Gold*, and this is found in the Mine *at Knein*, two miles from the *Eal* in *Bohemia*, towards the *West*, where there is also found a *grenish Silvery* Flint, in a firm *Quarry*; and when this is ground and wash'd, then a fair and high *Duke Gold* comes out of it, which otherwise is not seen in the *Flint*, at the present: I know no place in *Germany*, where, out of any Oar, any higher *Gold* can be made.

5. *Gold in Woolfrain, Tin, and Iron Oars.* **Shurl*, ger. Further, all *Goldish oars* (which are commonly *sandy*) have good *Duke gold*, yet not all alike, some are gross and in *grains*, others are flaming and *light Gold*, and there is almost in all such works a heavy * Temper (or *wolfram wash*) especially in *Tin* and *Iron stone*, which with the *Gold* have been driven far by the Deluge, and it is both wonderful and neat, and the work and colour

6. *Why the Rivers carry Gold with them.* and difference may easily be discerned, of these sorts: and the *Rivers* and *Channels* which do flow over such works are so feeded with it, that *Duke gold* in many places is found in them, not only in remote *Kingdoms* and Countryes, but also with us in *Germany*, it is brought to profit, yet in *Germany* for the most part it is poor, and cannot bear the charge of *Washing*.

7. *Of the River Nile.* But some old Writers say, That (out of the River *Nile* in *Ægypt*, which did flow into the Sea in the time of the *Deluge*, in which all Sand was brought together) other *Rivers* and Channels have also been feeded with *Duke gold*; But, to this I cannot consent, for this Reason

Reafon, Becaufe this River is very great, and goeth through that part of *Ethiopia*, (which is called *India*) in which alfo is found much *Gold*, and it is faid to be the greateft of all other *Rivers*, and doth flow the furtheft; yet I efteem it much too fmall to inrich fo many *Gold-Mines* with *Gold-fand* and channels in fo innumerable places of the World. CAP. I.

There is alfo with us in *Germany* all forts of *Grains* which are found in many Mountains and Channels, and are carried away by out-landifh men; fome of them are flinted, in part brown yellow and black, and within like *Glafs*, and in form commonly round, and alfo fquare, of which, as 'tis faid, *Gold* is alfo made: for my part, I efteem fuch not at all, becaufe I have affayed many times fuch *Grains* in the Fire, and other ways tryed, but could not find *Gold* in them. But thus much I have from very credible Perfons, who have affured me, That fuch *Grains* have not *Gold* in them, nor none is made out of them, but by fuch perfons brought far into *Italy* and other places, for an Addition, out of which fine Colours and *Amel* is to be made, which colours and *Amel* by them is thus efteemed and fold dear, as if it were *Gold*, which alfo is agreeable to reafon and may be believed, efpecially becaufe many forts of *Mines*, with us in *Germany*, are found which do yield *gloffy* and fine *Colours*.

Section. 8. *Grains which are carryed away by Foreigners.*

Further, fometimes with the digg'd *Gold* (which lies in *flints*, efpecially in the Gold-Mine at the *Eal* in the Kingdom of *Bohemia*) there breaks a fmall grey fpiffy Oar, which, after its colour, is called *Iron-man*, that fame alfo is not only rich in *Gold*, but 'tis alfo *filvery*, therefore it is not to be compared with the other *dig'd Gold* which ftandeth in *flints*. Alfo there is found much *Gold flints* which have not only *Gold* but *filver* alfo, and commonly more of *filver* than *gold*, likewife *flints* which are very

9. *Gold in Iron-man Oar.*

10. *Gold in flints.*

Cap.II ry *copery* and *ſilvery*, the *ſilver* of it is alſo rich in *gold*; as alſo ſome *white flints* which have no *Copper* at all,and but a little *ſilver*, and are *goldy*, but the *flints* which are *coppery*,and whoſe *Silver* hath *Gold* are found commonly with ſmall *flints* intermixed.

Section. 11. *Gold Marcaſite.*

Concerning the *Marcaſite*,of which many make Fables, and do write as if it were a meer *flint*, is very rich in *Gold* (becauſe it doth not looſe the fourth part in the Fire) and in *roaſting* and *glowing* becomes more and more fine: I have many times diligently enquired after it, but never receiv'd any good account concerning it, much leſs could I hear of one who had ſeen ſuch a *flint*.

But, as far as I can comprehend, the *Marcaſite* can and muſt be nothing elſe than a very good *Gold-oar*: Now whether this Name be given it, or any other, it matters not: But how theſe (one after another call'd *Gold-oars* and *waſh'd Works*)are to be proved and try'd, ſhall plainly follow.

CHAP. II.

What Proofs *and* Waſhings *the* Gold-waſhers *uſe in* Gold-works.

1. *How much may be waſh'd in a day.*

GOLD-*Waſhers* who go abroad in the Country for *Gold-waſhing*, and get their Livelihood by it, they have for the *Gold-works* a ſpecial proving, whereby they do obſerve how much *Gold* they waſh in one day, and accordingly make their Accounts, whether the VVork will bear the charge of Waſhing, and whether it be *poor* or *rich*, and to this *Proof* they uſe a particular *Weight*, which is divided by the weight of an *Hungary-Gilder*, after the

worth

worth of ſo much as is uſed to pay for ſuch *waſh-Gold.* Cap. II

Section. 2. *Of Creicers Golden and a Peny-Weight.*

But becauſe commonly 92 *Creicers* are given for an *Hungary Gilder* weight of *waſh Gold*, therefore they make forth the greateſt weight as high as an *Hungury Gilder*, and ſign it with 92 *Creicers*, the ſecond piece or half of the weight with 46 *Creicers*, and ſo of all the other pieces, one after another, with their Worth, till to the ſingle penny, as followeth,

92	*Creicers*	the weight of a Gilder.
46	*Creicers*	the half Gilder.
23	*Creicers*	the fourth part of a Gilder.
12	*Creicers*	
6	*Creicers*	
3	*Creicers*	
2	*Creicers*	
1	*Creicers*	
2	*Penny* weight	*Bohemiſh Money.*
1	*Penny* weight	

3. *Of Gold Grains.*

By theſe Weights every one may be informed of a grain of *Gold*, how much it is worth when weighed, therefore commonly the *Gold-waſhers* which go into the Lands for ſuch Work carry with them ſuch a Weight, with a black,* *SicherTroy*, and a little Box full of *Quick-ſilver*, and a *ſoft Leather*, a proof *Teſt*, and a little *Ballance* (to all theſe things pertaining) then as ſoon as one of them enters upon a ſandy or *ſoft Work*, and worketh upon it: if he finds *Gold* in it (how ſmall ſoever it be) then doth he cleanſe a little of it, and doth cauſe it to enter cleanly into the *Quick ſilver*, and doth afterwards preſs it through the *Leather*, from it, and that which doth remain in the *Leather* he puts upon a *Proof Teſt*, into the fire, which he doth preſently kindle, either in the Woods

a hair sieve.

* Sichertro-egel.

CAP.II Woods or Mountains and cauſeth it to go off, and the Gold to be red-hot, and what it doth afterwards weigh according to his *Creicer* and penny weight, ſo doth he make his Reckoning, how much of ſuch *Oar* he can waſh and make it return to an account in one day, and ſo in a Week.

Section. 4. *To prepare Boards for Waſhing it.* If upon Search he doth find by ſuch proof that the *Waſh-work* will recompence his labour pains and charges, then each one, according as he is beſt inſtructed doth waſh the ſame, and make his profit thereby, among which there are ſome who do waſh that which doth lye in the Fields under the moiſt earth, as alſo the Sand out of the *flowing Rivers* or Channels, and do waſh it over a *Board*, in which are cut little *Gutters* and *wrinkles*, here and there, into which the heavy *Gold* will deſcend and remaineth; but part of it will waſh over, eſpecially if the work be rich and hath *grain Gold*; but if it doth go ſlow, it requires more pains.

5. *A ſpecial good waſh work.* Some years paſt, there was found upon ſuch Work and ſand, by the water-ſide, a ſpecial *waſh-Work* by which, in one day near 300 weight of rubbiſh have been waſh'd away, and the *Gold* ſaved: which is done thus, There muſt firſt be made of *Braſs Wire* a *Rattar* or

6. *The Bigneſs of the Rattar.* Seeve as wide or narrow as the *Work* requireth, and it is to be tyed from above downward with *Braſs wyer*, and it muſt be ſtretch'd faſt upon *Iron-ſtays*, that it may not bend or riſe, the bigneſs of the *Rattar* is to be ſeven ſpans long, and five wide, and in depth a good ſpan, with a bottom that doth enter two thirds into the *Rattar*, and with one third part to be extended for carrying the matter out (which is to be done over with *Tin*) the *Rattar* muſt alſo have, on each ſide, little wooden pieces faſtned to it, by which he may reach to the foremoſt Inſtruments, that the *groſs* matter that doth not go through may eaſily be emptyed.

As

As alſo the lower bottom under the *Rattar* muſt have on each ſide *Boards* faſtned to it,that nothing may fall from the *Rattar*, for from that place the Work paſſeth from the *Rattar*, upon the *flat* hearth (which is to be thirty ſpans in length, and four broad) and the Chanel through which the Water doth run-out muſt be wider than that above, and alſo covered-over with *Tin*: to this there is alſo Water uſed more or leſs, according as the Work is foul or ſandy. CAP. II

Section. 7. This *Waſh-work* ſerveth only for *Sandy-works*, but not at all for the clean and deft: yet becauſe this work is not common to this day, therefore (for them that have not ſeen it) I have delineated it in the following *Sculpture*, thus

Deciphered.

1. *The man that worketh with the* Rattar.
2. *The* middle Floor *whereon that which goeth through the* Rattar *doth fall.*
3. *The* lower Floor *whereon that which cometh from the middle* Floor *doth fall.*
4. *The* Plain Receiver *of that which falls from both.*
5. *The* perſon *that ſtands on a* Board, *and out of a* Wheel-barrow *throws the Matter or* Oar, *into the* Tunnel, *which guides it into the Rattar.*
6. *The* Channel *in which Water doth run into the Rattar.*

Sculpture XIV.



Section: 8. *Of Seircing Gold Oar.*

Then some of the *Gold-washers* use upon their hearths the strong *Timode* black and russet *woollen Cloth*, over which they do drive their Works, because the woollen cloth is rough and hairy, so that the small and round *grains* of *Gold* will remain, and not run forth (as it will from the *Timode*) whereby the Gold (upon the black Cloth may apparently be known, though it be small and little.

Others

Others uſe in ſtead of the *Timode* or black woolen Cloaths *Linſy-woolſy* (half linnen and half woollen; wrought in themanner as the *Timode* is) upon which the *Gold* doth ſtick better, and ſuch *Cloths* do laſt longer, becauſe of the *Linnen* that is among the *Woollen* which doth ſtrengthen it, therefore it is better for this Work. CAP. II Section. 9. *The ſorts of cloth to be uſed for ſeircing it.*

But there is another way of *Waſhing* (not much in uſe) which is called *Driving and Waſhing through the long Rattar*; but according to my mind, it is not ſo convenient a way for the ſmall VVorks, which have great and ſmall *Gold*, and are both ſand and Clay together, yet I do not much decline from the before deſcribed *Rattar-work*: For, in this Labor or waſhing, becauſe of the turning in the upper and lower falls, the running *Gold* is preſerv'd better, and the *Gold* goeth with the ſmall common Work over the plain hearth, upon which it is driven: and the manner of doing it is ſeen in the following *Sculpture*; thus 10 *How to uſe the long Rattars.*

Deciphered

1. *The* Miner *which caries the matter to be* waſh'd *in the* Rattar.
2. *The Parts of the* Rattar, *more viſible than in the former* Sculpture.
3. *The* Waſher *that governs the* Rattar.
4. *The* upper *and* lower Falls *from the* Rattar.
5. *The plain* Boards, *or* Hearth) *on which they fall.*
6. *He that ſtirs about the* muddy water *from both* Fallings.
7. *The* Tub *wherein that which falleth from the* hearth *is to be waſh'd.*

Sculpture

Cap. II

Sculpture XV.



Section. 11. *To purify the Gold Slicks.*

Thus much I was willing in ſhort to diſcourſe about the *Gold-Waſhing*, as a Direction how the Work is to be done to Advantage. If now a Work be rich, then it is the better, and then may eaſily be found and uſed a manner of Waſhing, that the looſe *Gold* by it may be preſerved: and when the *Slick* is brought into a narrowneſs, and the *Gold* drawn out with the great Inſtrument, or with the ſlender and long one (which is called a *Saxen*)

Saxen) then may it be quickned and pressed through the *Leather*; then glow out and cast all together, of which more shall be written in what followeth. Cap. II Section.

Thus far *I* have spoken of the *Gold* and **wash-works* which do need *Boxes*: Now *I* intend to write also of the *Gold Oars* which are had in the *Mines* out of the *Veins*, and how that must be *buckt* or *washt*; in which the *digg'd Gold* is clearly to be seen, and such must have a special way of preparing it) namely, those *Oars* in which the *Gold* standeth in great *Grains*, and may be parted with the hand, or beaten in a great *Iron* Mortar, and, if there be much, then set it over a *Seeve*, made on purpose, and so cleanse it, and it needeth no more pains, nor greater Art: and it is better than that the *Oars* (without difference) were brought under the *Buck*, or washing place (especially because one useth to observe such a hand parting in smaller Mettals, as *Silver*, *Copper* and *Lead* Oars.) 13.

* Seyfen or Soyer.

Of great Grain'd gold.

But the poor *Gold* Oars which are mingled with small Gold (and cannot be separated with the hand) the same if they can be wrought without *Roasting*, may be *Buck'd* and prepared two wayes, *viz.* by a wet and a dry *Bucking* or beating; by the wet *Bucking* is the *Oar* washed through *Tin* plates and Channels (and like unto *silvery* Oar, driven over a plain *Hearth*, and afterwards made clean) but in the dry beaten Work, the Floor is driven over the plain *Hearth* with Woollen or *Linsy-Woolsy* stuff (as above, where the Gold-work hath been taught) and so wash'd and made clean and quickned. 14

How digg'd Gold is mingled.

There are also *Flinty* and *Horn-stony Gold Veins*, in which the *Gold* is very subtil and thin, and is mingled with other *Water-flowing Gold Oars*, the best way of preparing them is, That such *Flints* and *Horn-stones*, provided there may be had Wood enough in the place, 15.

Flinty and Horn stony Gold Oars how to be us'd.

CAP.II may in a ſpecial *Roaſt Oven*,made on purpoſe,be burnt: firſt, very hard and well, and when it ſtandeth in the greateſt heat, pour water upon it, that it may cool ſuddenly, and ſo the ſubtil *flaming Gold* will be, as it were, frighted, at the incorporated *Oar*, and run together, and become a round Body, and is ſtrengthned and remaineth the better in *waſhing*, alſo 'tis better preſerv'd: likewiſe, the *Flint* by quenching doth become ſo brickle, that afterwards in great quantity, it may eaſily be *buckt* and ſeparated, and is not ſo hurtful (after it is *roaſted*) to the tender *Gold*, as before when it was raw) becauſe the hard *Flint* among the *Gold-Oar* doth more hurt in *Bucking* in reſpect of its weight, and the *muddineſs* carrieth away ſome of the *Gold* with it,in the *mudy Water*,but ſeing that it is very rare to find plenty of wood in ſuch places where *flinty*, *Horn-ſtone Gold Veins* are; therefore every one is left to try the beſt way.

Section. 16. *Roaſt ovens.* The *Roaſt-Ovens* in which thoſe *flinty Oars* are *roaſted*, and afterwards quenched with water, make them thus: Give to each *Oven* two *Ells* in ſquare, and ſix *Ells* high, and cauſe it to be built up with ſtones, that the Oven before the lower part may remain,open ſo high that the roaſted Oar may be drawn out of the hole (after the Oar which is to be roaſted is put in) then it muſt be cloſed up with Clay, alſo there muſt be in the Oven, in ſtead of the *roaſt*, Separations, made of *Tiles* an *Ell* high,upon which the wood is to be laid, that the *Wind* may go between the *Tyles* into the *Oven*, whereby the fire may burn clear.

VVhen you intend to roaſt in ſuch an Oven,then lay into the *Oven* upon the *Tile-ſtones*,ſhort ſplit wood, two *Ells* high; upon which put the *ſtony Oar*,as groſs as it doth come out of the Pit, but the ſmall which are not in very great pieces ſet along the ſides of the Oven. that the great pieces may be in the middle, ſo that the flame and heat

heat of the fire may wind about it, and alſo the heat of the fire remain together in the Oven, and force it ſelf through it to the top of the *Furnace*, and ſuch forand incloſed *Heat* doth much more than in an open *Roaſt*, and when the Roaſt in the *oven* burneth at the fierceſt, then muſt water be poured on it, and be quenced ſuddenly, therefore ſuch a *Roaſt Oven* for better Advantage is to be built in ſuch a place where water may eaſily be poured into it, ſo the ſubtil *Gold* will run together in *grains*, and the ſtone will becom brickle (as hath been ſaid before) although the ſame do become brickle only with burning, yet it becommeth more brickle by quenching, and it is done more eſpecially for the *Gold* ſake.

Cap. II

Section. 17. *To quench the Roaſt.*

The form of ſuch *Roaſt-Ovens*, and how they muſt ſtand in its proportion and ſhape, will be ſeen in this following *Sculpture*, thus

Deciphered

1. *The Form of the* Roaſting-ovens.
2. *The* Shutters *to them.*
3. *The* In-ſide *of them.*
4. *The* Partitions *in them, made of* Tile, *and a perſon atending at the mouth of them.*
5. *He that pours Water into the* top *of the Oven.*
6. *The* wood *that is uſed in thoſe* Roaſting-ovens.
7. *The* Inſtruments *to cloſe the* Ovens.
8. *The* Ladder *to go to the* Top *of the* Oven.
9. *The Pieces of* Metal *that are to be* uſed.

Sculpture

Cap.II

Sculpture XVI.



If there be a great quantity of the *Gold-ſtones*, then
Section. 18. there may be made more *Ovens*, as alſo bigger, and according as neceſſity requireth, regulate them that the Fire may have its full force.

Thus much *I* was willing to mention concerning the Preparation of the *Gold Oars*: But becauſe *I* have not from my youth, medled ſo much in it, as with other *Oars*, therefore have *I* ſhortned my Diſcourſe: and others that know better Methods have their Liberty to inlarge.

CHAP.

CHAP. III.

Of Gold Slicks.

Section. I. Of poor Gold slicks.

FURTHER, know alſo that when the *Gold Oars* and *Gold Slicks* are cleanſed for to quicken: and the *Gold* drawn out, with the *Quick ſilver*, and hath been *quickned*, yet there will remain from the quickning a *Slick*, of which ſome is poor in *Gold*, and ſome rich, yet the rich Slicks may be made to pofit and melted like as a rich *Silver Oar:* But the other common *Gold Slicks*, eſpecially if they be of the *Gold-Mine* at the River *Eal*) are *flinty*, and that the Centner which hath but a dram of *Gold*, cannot better be melted than over the raw *Slicks* into *Slackstones*; but if the *Slicks* be not *flinty* of themſelves, then there muſt be another *flint*, (which yields much *Stone*) added to the *Slick* in melting, and when the *slackſtone* doth not come out rich in *Gold*, then add more of ſuch Flints to it, to help the *Flint*, until a Centner of the *Slack-ſtone* doth contain 13 or 14 *Drams* in *Gold*, but it muſt not be wrought by adding more to it,becauſe if it ſhould become too rich in *Gold* (it is to be feared that) the *Slakes* would remain too rich: therefore, if there be enough of ſuch *flints* to be had, let them be added to it; or if the *Slick* it ſelf be *flinty*, and yield *ſtones*, then 'twere better that the *Slackſtone* were brought no further in Contents, than to 10 drams of *Gold* in the *Centner*, and ſo the *Slack* will remain the poorer: thus the *Iron flaky Oars* (which have very ſubtil flaming *Gold*, and commonly the *Centner* of

CHAP. III. it doth contain a dram or two in *Gold*) may return to great Advantage.

Section. 2. *Of rich flicks.*

But the rich *Gold Ram* or *Slick* (out of which *Gold is quickned*) which in part uſeth to be very rich in *Gold* that ſometimes it doth contain a *Centner* from three to many *Loths* of *ſilvery Gold*, ſuch can no better way be melted than with *Lead*; yet becauſe that ſame *Slack* is very ſubtil, therefore the blaſt in melting doth raiſe it up very eaſily, ſo that it doth fly out, and is loſt by it: to prevent this, Let the *Slick* be mingled with ſtrong Yeſt, and let it dry, then break it into *Bits*, or before it is quite dry, cut it to ſmall *Bits*, and put it into the Oven, and ſo it will remain better in the fire.

3. *To bring both to Profit.*

'Tis neceſſary *I* further direct, That when one hath a *Gold Slick*, and would melt it, and that a *Centner* thereof doth hold from two to five drams of *Gold*, and is not ſtony in it ſelf, there muſt be other *flints* added ſo that the *flint* and *ſlick* may not be throughly mingled together, nor run upon the *ſlick*, for by this there will be danger, becauſe the *flint* doth ſpread it ſelf, and gives a little rough *ſtone*, whereby there will remain much of the *Gold* behind, but weigh the *flint* and the *ſlick*, each by themſelves, and if any of it be melted, ſo much (according to the quantity, partly *flint* and partly *ſlick* and *ſlacks*) muſt be ſet into the *melting Oven*, and it will fine it ſelf well enough together, and by this means (as Experience teacheth) more *roughſtones* and more *Gold* will be wrought out, than if ſuch ſlick, flint and ſlacks had been mingled together, becauſe the work remaineth cloſe together and is not ſpread.

x rough.

CHAP.

CHAP. IV.

How Gold-Slicks *with* Gold *from digg'd* Oar *are to be prepared.*

WHEN the *Gold-flicks* which do contain *Gold* are made clean,and there is a defire to make more profit of it, by quickning and getting the *Gold* out of them, then the flicks muft firft be prepar'd in the following manner: *viz.* Take good ftrong *Wine Vinegar*, put into every gallon half a pound of *Allum*, caufe it to boyl up a little, and then let it cool, then put the *Gold-flicks* in a clean prepared Veffel, and pour the prepared *Vinegar* upon it, that it may cover the *flicks*, let it ftand two or three nights in it, and work well upon it, fo the *Vinegar* will make a frefh ground to the *flamy Gold*, that it will not eafily enter into the *Quick filver*, and that which is yet among it of *deft Oar* will become flimy, and the *Gold* is made lefs, and when the *Vinegar* hath ftood the mentioned dayes over it, then feparate the *Vinegar* clear from it, and wafh the *flicks* clean and fair with warm water, and let it dry, then put it in the grinding Tub or wooden Veffel, and fo much *Quick-filver* to it as the quantity of the *Gold* in the *flicks* doth require,and rub it well together with the hands, afterwards with a wooden Peftel, fitted for it, grind it well and fo long, till the *Quick filver* hath taken up all the *Gold*; when this is done, then pour warm water upon it, and wafh the *flicks* and *Quick filver* clean, and pour out the muddy matter, and the *Quick filver* will run together again: which

Section. 1.

CHAP. IV. which muſt be ſeparated very clean from the *ſlicks*, that nothing remain behind, becauſe it is more *Goldiſh*: when this is done, dry it with a *ſpunge*; and put it in a double ſtrong *Timode* or into a fine leather (which is better) and force it with a ſtrong Coard ſo as the *Quick-ſilver* being ſo preſt will paſs through ſuch *Timodes* or leather, and the *Gold* with almoſt as much *Quick-ſilver* will remain in the *Leather*; put this on a *flat Teſt* upon a coal *fire*, and the remaining *Quick ſilver* will *cooperate* and the *Gold* will remain alone; then glow it well and melt it together before the *Bellows* with *Borax*, ſo long till it doth hold the wind, then pour it into an *Ingot*:

Section. 2. *To preſs the Quickſilver through Leather.*

☞ The prepared Vinegar (as hath been ſaid) with *Allom*, is for the moſt part uſed by all *Refiners*, but they quicken *Gold* only ſimply with *ſlick*, but 'tis better that ſuch *Vinegar* be prepared and uſed.

3. *When the Gold holds Silver.* But if the *Gold* be a little *ſilvery* (as commonly *waſh Gold* is, which do not come out of an higher Content than they are in the *Oar*) beat it thin, put it in Cement, as hereafter ſhall be diſcourſed, then it will be clean and have a high *Colour*.

4. *To pick out the digg'd Gold.* What *Gold* hath been pick'd out and is wholly dig'd (or elſe ſeparated by the hand) ſuch *Gold* may be melted with *Borax* and caſt, and if there is yet any uncleanneſs then ſet it firſt upon a *flat Teſt*, let it drive with a little *Ball* of pure *Lead* until it doth hold the *Blaſt*, and afterwards again with *Borax* melted into an *Ingot*, and ſo it will be deft.

This manner of quickning doth ſerve upon all *ſlicks*, (which have digg'd *Gold*) becauſe as the ſame is waſhed in Sand, and pick'd out of the *Oars*; in the ſame manner it will come out in quickning, and doth not hurt the *Quick-ſilver* at all, and when it is forced out, then may it be uſed again.

5. There have been alſo ſome *Gold-waſhers* which have had

had a ſingular manner in the *Gold-waſhing* and *quick-ning*; namely, they have firſt ground in a Mill the *Gold Oars* (or *Slicks*) very ſmall (as ſmall as Meal) afterwards they have moiſtned it with ſtrong, hot *Salt-water*, and have mingled it very well like unto *Copel Aſhes*, that the *Salt* may every where touch the *Slicks* upon the *Oar*; and while the *Salt water* is yet warm and hot they have upon five pound of the *Oar* poured twenty pound of *Quick ſilver*, and have mingled the Slick or Oar ſeveral times with it, and ſtirred it well, ſo long untill the Quick ſilver could hardly be diſcerned in it; and they have afterwards put the Oar into ſeveral Veſſels full of Water, made on purpoſe, and have ſtirred it, but one Veſſel did always ſtand lower than the other, that that which did fall out of the upper veſſel, (and ſo to the ſecond or third) might be received and ſettle in the fourth. CHAP. IV. Section. 5.

* And thereby waſhed the moſt of the *Muddineſs* away; then they have taken the Oar and mingled it with the *Quick ſilver*, and put it upon the *Mill* (which hath an hollow ſtone) and have ground it with water, that it might flow through it, untill no more *Muddineſs* did go from it, till all that which is come through the *Mills* be ſetled in the Veſſels and preſerv'd, ſo that nothing was loſt: Laſtly, the *Quick ſilver* was taken out of the *Mill*, and with diligence kept together, and dryed, and preſſed through *Leather*. This Work I like well upon great Quantities of poor *Oars*, in which the digg'd *Gold* is very ſubtil and not *flinty*, and yieldeth no ſtone, which cannot be melted otherwiſe to Advantage.

This is a neat work, and is worthy of Deliberation; But I for my part have this further Conſideration in it, That poor *Gold ſlicks*, cannot be much Charge; becauſe, firſt, the *Slick* muſt be ground, and the Charge of the

Chap. V. *Salt* or mingling, well conſidered, as alſo the Charge of the other grindings, and the waſte of the *Quick ſilver*; but laſtly, to make the *Gold* compleatly clean (beſides the charges of the building up of the *Gold-Mill*) 'tis neceſſary to be careful herein, for, ſome *Gold-Oar* may have ſo much ſubtil *Gold*, as will pay richly for all the Charges.

CHAP. V.

How Clean Gold-ſlicks *are to be made to profit without* Quickſilver.

Section. 1. *By* Lead-glaſs, *&c.*

IN want of *Quick ſilver* one may melt the clean and rich *Gold ſlicks* with *grained Lead*, *Litharge* and *Lead-glaſs* in a *Crucible* with a little of *Caput Mort.* and *Sandiver*, and cover it over with *Salt*, and ſo cauſe it to flow well in a *Wind-Oven*, and afterwards cauſe the *Regulus* to go upon a *flat Teſt*, becauſe of the *Black-ſtoney Veins* there will be alſo much fine *ſlick* thruſt out among the *Iron*, therefore the *Iron* is firſt to be drawn out with a good *Loadſtone*, otherwiſe it will be much hindred in the *upboyling*, but if the *Gold ſlick* be *flinty* or the like, then it muſt firſt be *roaſted*, ſo all the *Gold* which is not looſe in the *ſlick* will enter into the *Regulus* of *Lead*, and be made to profit.

2. *To make firm Teſts for Gold.*

The *Teſt* to ſuch work muſt be prepared with *waſh'd Aſhes*, among which muſt be mingled half the quantity of *ſmall Bone-Aſhes*, and a little *Potters-clay*, and the upper part muſt be done over with good *Clar*, that nothing of the *Gold* be drawn into it, and when it is all thus prepared, then water muſt be poured into it, and let it ſuck it in, whereby the *Teſt* will be made firm and good, and

and when the *Gold* is gone off upon the *Test*, then take the appearing *Gold*, which is yet unclean, put it upon a *flat Teſt*, done over with a little *Clar*, and let the *Bellows* blow upon it, ſo long until the *Gold* doth endure the blaſt, and ſo it will be deft, and then you may (if it have yet a little ſmoak of *Lead*) cauſe it to melt in a *Crucible* with a little *Borax*, and caſt it into an *Ingot*, or preſently let it go into the Cement, as hereafter you will be inſtructed. CHAP. VI.

Section. 3. *To boil up the clean* Gold ſlick.

The *rich cleanſed Gold ſlick* may alſo be boyl'd up with the following *Fluſs*, like unto the *Copper Oars*: thus, Take *Slick*, mingle among it twice ſo much *Fluſs*, put it in a *Crucible* cover it over with *Salt*, cauſe it to flow well, with a ſtrong heat in a *Wind-furnace*, and there will be as much *Gold Regulus* in the Crucible as there was in the *ſlick*; then cauſe it to cool well, and knock the *Regulus* clean off from the *Fluſs*, but becauſe it is yet unclean from the *Fluſs*, therefore cauſe it to go off upon a *flat Test* with a ſmall *lead Ball*, until it melts and becomes *deft*: and altho in the quantity of the *ſlick*, the quickning is moſt fit to be uſed, yet there may (by this *Upboiling*) be ten pound at once melted in a *Crucible*, and the *Gold* be brought into a *Regulus*.

CHAP. VI.

Of Fluſs *to* boyl up *the* Oars.

FLUSS (of which hath been ſpoken) is made thus, Take one part of *Salt-peter* and two parts of *Argol* (both ſtampt ſmall and mingled together) cauſe a glazed *Pot* to glow, put the matter into it, and cover the *Pot* quickly, ſo the *fluſs* will be

CHAP. VII. be prefently burnt out and become a *black-grey Pouder*; or elfe, when the pulverized matter is put into the *Pot*, then put a live Coal into it,fo it will burn out to a *Flufs*, mingle alfo *Salt Petre,melted Salt and Sandover*,and*crude Argol* with it, then is the *Flufs* ready.

CHAP. VII.

How Gold *may be feparated very clean from the* Quickfilver.

Section. 1. *The ufe of* Quickfilver *in this work.*

AFTER Gold is quickned, and the *Quick-filver* prefs'd through a *leather* and forc'd from it, yet there will remain commonly a little *Gold* with it, efpecially when the *Gold-flicks* and *Gold Oars* have been poor, and that the Quickfilver did not become rich, fuch Quickfilver may be preferved for other Work of the like nature. But if there were no more fuch *flicks* to be done, yet the *Gold* (which did go with the *Quick filver* through the *Leather*) muft be feparated from it very clean, by an *Artificial Separation*, and fuch *Quickfilver* doth commonly contain two or three *Loths* of *Gold* in the *Centner*, efpecially when the *Quickfilver* came from poor *flicks*, and fuch Separation is done thus,

2. *How a* Iron *Jug or Pot is to be made* and Loamed.

Caufe an *Iron Jug* to be made, which may be taken afunder at the belly, *lute* the lower part of the infide, about half a finger thick, with very good and weighty *Loam*, (that will hold well in the *fire*, and not crack) caufe it to dry, fet the upper part upon it, and bind them both very faft, and clofe together with an *Iron Wyer*, and then do it all over on the out-
fide

ſide with good *Clay*, and when it is dry, then ſet it in an *Oven* (which is called an *Athanor* with which one uſeth to burn *Aqua fortis*) and put in it fifty pound of *Quick ſilver* (if you have ſuch a quantity of it) and place an *Helmet* upon it, and alſo an *earthen Jug* before it, in which there muſt be full three quarts of *Water*, and all muſt be *luted* well on the outſide, and cauſe it to dry, then let the *fire* burn by degrees to be ſtronger from one hour to the other, untill at laſt the *Jug* be very red, yet make it not ſuddenly hot, that the *Jug* may not burſt, nor the *Quick-ſilver* fly out, ſo the *Quick-ſilver* will all come over into the water in the Receiver, which when the fire is kept in good order) is done in ſeven or eight hours: when all is come over, then let the *Jug* cool well, and take it out of the fire, and open it, ſo will you find all the Gold in the bottom, then take it from the *Loam*, and let it flow together. CHAP. VII.

After this manner (now directed) the *Gold* which remaineth in the *Leather* (which hath *Quick ſilver* with it) may be put in and drawn off: and the *Quick ſilver* may return to Advantage.

3. *To refreſh Quickſilver*

But becauſe the *Quick-ſilver* will become a little weak from the drawing over (ſo that it will not attract ſo ſoon as in the beginning) and if you would have it freſh again, then put it into a Veſſel of Wood, draw warm *ſalt Water* upon it, grind it with your hand well together, and dry it with a Spunge, then it is as good again as it was before, and you may uſe it again: alſo there is no great loſs by it in the drawing it off, if the *Pots* and *Glaſſes* be well *luted*.

4. In caſe you cannot have always in readineſs an *iron Jug*, cauſe one to be made of earth (which will endure the fire) and lute the ſame likewiſe with good and firm *Clay*, as you did to the *iron Jug*; ſo put the *Quick-*

CHAP. VII. *silver* into it, and *Helmet* upon it, and set before it the *Jug* with water, and *lute* it well altogether, then force the *Quick silver* over it, and you may have it again for use, but such Labor is performed with Sorrow and danger, because if such an earthen *Jug* should crack or spring then the *Quick silver* will be lost, and will evaporate to smoak, therefore there must not be so much Quicksilver put in it, as into an *iron Jug* or *Pot.*

Section. 5. *Another way to draw off the Gold.* Some use to put upon such a *Jug* an earthy blind *Limbeck* (that on both sides hangeth over) and therein they put water, and draw the Quicksilver from the prest *Gold* in it, and when it is a little cool, they put it out through the *Pype* which is above on the *Helmet*, and then the *Gold* will remain on the *Jug.*

Now, which of these (that is found most serviceable and convenient to any one) he may use: only take notice, That, if you let the smoak away and the remaining Quicksilver from the Gold (without distillation) take heed the *smoak* or vapour go not into thy *Belly*, because it is a *poysoning* and cold *Vapour*, which lameth and killeth: for, he will find that it will there congeal and afterwards spoil his body.

Now, that the Reader may know how the *Jug* and Instruments are to be made which are to be used for quickning, and attracting, he may find exactly in the following *Sculpture*, which is thus

Deciphered.

1. *The* Athanor *or great* Furnace.
2. *The* Ovens *on the sides of it.*
3. *The* earthen Receiver *for it.*
4. *The* earthen Helmet *for it.*
5. *The* blind Helmet *with a* Pipe *by which water may be pour'd in.*
6. He *that sitteth the* matter.

7. He

7. He *that presseth the* Quicksilver *through a* Leather. Chap. VII.
8. *The* lower part *of the* iron pot *or* Receiver.
9. *The* upper part *of it.*
10. *The* Leather purse *for the* Quicksilver.
11. He *that causeth the* Gold *to* melt, *by help of the* Bellows.
12. *The* Pieces *of* Metal.

Sculpture XVII.



Chap. VIII.

CHAP. VIII.

How Gold-Oars *are to be proved for* Gold.

Section. 1.

GOLD Oars are of two ſorts, one is partly *flowing*, the other partly *harſh* (as is diſcours'd in the *firſt Book*) Now from the *ſilver Oars* the common Aſſayers have had in their proving *two Proceſſes*, namely, upon the mild and flowing *Oars*, viz. the *Iron-ſtreamy* and *bright Oars*) and ſuch as are without *flints* : their *Proceſs* was thus : They uſed to grind their *Oar* or *ſlick* very ſmall, and have weighed a *Centner* of the *Fluſs*, which they had prepared for the *Gold-Oars*, (as we ſhall diſcourſe hereafter) and have mingled altogether, and did put it into a clean *Crucible*, and covered it with *Coals*, and have ſet it before the *Bellows*, and did blow about it, and when the *Fluſs* was melted, then have they put fifteen *Centner* of clean *Lead* into it,and when it did begin to *ſlack*, then they take the Crucible out of the fire, and ſuffer it to cool, then beat the *Regulus* with the *ſlacks* out of the *Crucible*, and put it together upon a proof *Teſt*, in an Aſſay Oven, and have cauſed it to boil up, and *ſlack* again, as other *ſilver Oars*; and have ſtirr'd it about with a clean *Iron*-hook, and when it was vvell boyld up, they did let it cool; finally, they have beaten off the *ſlacks* from the *Work*, and upon a well *nealed Coppel* cauſed it to go off, but they have made their *fluſs*, (for ſuch proving) of one part of *Litarge*, and one part of *Antimony* well ground together and melted them, and when they did intend to uſe

it

it with ſuch *Oars* (as were not *Iron-ſtreamy Oars*) they added a little *filings* of Iron, that the *fluſs* might have ſomething to *devour* and not hurt the *Silver* and *Gold*. CHAP. VIII.

Section 2. *The flinty Gold Oars.*

But the *flinty Oars* and ſlick which are harſh and unflowing they have aſſayed according to the former way, only they have firſt *roaſted* it, and ſome do quench it in the roaſting with *Urine*, or with a particular prepared *Lye*, thinking thereby to obtain the more: But for my part, I do not eſteem ſuch *Proceſſes*, becauſe no more (by ſuch Labour) can be brought out by it, than by the following Method, which I eſteem more neceſſary, and through which the Proof may be accompliſh'd cleanlier, and in a ſhorter time: yet, becauſe the abovesaid Labour was by the Ancients in uſe, therefore I do leave it according to its eſteem with others.

3. *Another Proving.*

The other proving is done thus, take the *Gold-Oar* or *ſlick*, either *flinty*, *raw*, or *deſt*, as it happens, and grind it ſmall: Of this weigh a *Centner* with thy *Proof-weight*, and put to it fifteen *Centners* of *granulated Lead*, and mingle them together in an *Aſſay-Teſt*, then put to it a *Centner* of ſmall grounded *Lead-Glaſs*, and ſet it in a warm *Aſſay-Oven*, make it firſt hot ſo long untill the *Lead* beginneth to drive, and the *Oar* to riſe, then let it cool again, that the *Oar* may *roaſt* over the *Lead*, and riſe no more, then cauſe it be hot again, ſo will it *ſlack* very clean, then ſtir it about with an *iron Hook*, and let it ſtand a little longer, when 'tis enough, then take the *Teſt* out of the *Aſſay-Oven*, let it cool, and beat the work clean off from the *ſlacks*, and let it go off upon a *Copel*; when this is done, then draw up the *Grain* againſt the *Lead-grain*, and as much as it is heavier, ſo much doth the *Oar* or *ſlick* contain of *Gold*, or *Gold* and *Silver*, which thou maiſt know by this that when the *Grain* is very white, then put it in a ſeparating-Glaſs, to

Chap. VIII. dissolve in *Aqua Fort.* but if the *Grain* is too rich in *Gold*, so that the *Aqua Fort.* will not touch it, then add to the *Grain* a little fine *Silver* which holdeth no *Gold*: so that to one part of *Gold*, there may be three parts of *Silver* and cause this in a *Copel*, with pure *Lead*, to drive together: After this, take that *Grain*, beat it flat with an *hammer*, glow and dissolve it in *Aqua fortis*, as you have been instructed before, then pour the *Aqua fortis* off, and *dulcify* the *Gold* with warm water, put it out of the *separating Glass* and glow it well, when this is done, then draw it up with the *Proof Scales*, and you will see how much a *Centner* of the *Oar* or *slick* doth contain of *Gold* and *Silver*, and by this *Proof* the *Assayer* may know that all the *Gold* and *Silver* which is in an *Oar* is certainly found, and hath not need of other Circumstances, because the *Lead* doth take very willingly the *Gold* and *Silver* to it self.

But how the *Gold* is to have its due *dissolution*, *dulcification*, and what is else to be done with it, all this I intend to declare hereafter more fully.

Hereby one may know that there is no need to take any *Lead-glass* for such soft flowing or deft *Gold Oars* or *Gold-Slicks*, but it may easily be boyld up, by governing the fire; one may also do the *flinty Gold Oars* in like manner, only they are sooner and better boyl'd up when *Lead-Glass* is added.

Section. 4. *A fine* Gold Proof.

Some Assayers have also used to grind the *Gold-slick-flint* and other *Gold Oars* very small, and weigh them off, and put it in a *separating-Glass*, and pour into it good strong *Aqua fortis*, and they let it dissolve as much as it will, afterwards letting the *Aqua fortis* be evaporated, that it may all come hard in the *Glass*, they beat it out, and boil it up in a *Test*, with *Lead*, and cause it to go off upon the *Coppel*.

This proof I like well, and I judge, that if something more

more of *Gold* may be obtained, that it muſt be done this way: only the great quantities muſt not be regulated according to this Method: Therefore every *Aſſayer* is to take heed with good Diligence, that he may order his Aſſayes thus, that he may alwayes find the *Contents* as near as he can, ſo that he may afterwards in melting great quantities, find the ſame according to the proportion. CHAP. IX.

CHAP. IX.

How Gold *in* Lumps, Plates, Ingots *or coyned* Gold *is to be aſſayed, and firſt of* Touch-Needles.

BECAUSE in Touch Needles of *Gold*, there is often uſed much Deceit, eſpecially by ſuch who do buy *Gold* by the *Touch*, therefore to ſuch Proving it is neceſſary to make true *Needles*, without Deceit, That one may not be over-reached by touching, ſo as when *Gold* is brought to a high colour by *Graduation*, that ſuch a ſtroak upon the *Touch-needles* of eighteen *Carats*, with good Crown *Gold* may be made, and thereby may be judged. Section. 1. *Deceit in* Touch needles.

2. But firſt you are to be inſtructed that ſome ſorts of *Gold* (that come from ſeparating and have no *red*, but altogether *white*) cannot be touched upon a certainty with *Touch Needles* for *Gold*, on the contrary, ſuch which have much *red* and little *white*, as the *Crown-Gold*, with *white Needles*, which are made for the ſeparating, and *waſh'd Gold* muſt not be touch'd, much leſs can the *Rheniſh Gold*, which hath more *white* than *red*, be done by theſe now mentioned *Needles*, *I* will therefore firſt deſcribe the *Needles* which are moſt in uſe, how they muſt be *Of Gold and ſilver touch needles, called* red *and* white.

CHAP. X. be prepared and made, and afterwards the others also with this Caution, that every Assayer may take good heed that he may so well order his *Gold stroak*, that he may not be esteem'd as one without understanding, and that he may not come to Dammage, because through false *Needles*, not only they who are unacquainted with the several sorts of *Gold*, but also such who handle them dayly, are oftentimes deceived.

CHAP. X.

How the white Touch Needles *are to be made.*

Section. 1. TO all *Touch Needles* for Gold you shall take pure and fine Gold, although such can be as little demonstrated as fine *Silver*, and I judge such *Gold* to be pure and fine, which is cast and diligently blowed off, and afterwards beaten thin, and by *Cement* and other ways cleansed (of which hereafter) now you are to weigh such *Gold* off: (for Needles) with a singular *Carat-weight*, which must be a little more than a common *Carat weight*, and to every one must be allowed, as followeth.

2. Weigh to the first *Needle* 24 *Carats* of *fine Gold*, which maketh the *first Needle*: to the *Second*, weigh 23 *Carats* and a half of *fine Gold*, and a half *Carat*, or six *Grains* of *white fine Silver*: to the *Third*, 23 *Carats* of *fine Gold*, and one *Carat* of *white*: to the *Fourth*, 22 *Carats* and a half of *Gold*, and one *Carat* and a half of *White*: to the *Fifth*, 22 *Carats* of *Gold*, and two *Carats* of *White*: to the *Sixt*, 21 *Carats* of *Gold*, and two *Carats* and a half of *White*: to the *Seventh*, 21 *Carats* of *Gold*, and three *Carats* of *White*: to the *Eight*,

Eigth, 20 *Carats* and a half of *Gold*, and three *Carats* and a half of *White*: to the *Ninth*, 20 *Carats* of *Gold*, and four *Carats* of *White*: to the *Tenth*, 19 *Carats* and a half of *Gold*, and four *Carats* and a half of *White*: to the *Eleventh*, 19 *Carats* of *Gold*, and five *Carats* of *White*: to the *Twelfth*, 18 *Carats* and a half of *Gold*, and five *Carats* and a half of *White*: to the *Thirteenth*, 18 *Carats* of *Gold*, and ſix *Carats* of *White*: to the *Fourteenth*, 17 *Carats* and an half of *Gold*, and ſix *Carats* and an half of *White*: to the *Fifteenth*, 17 *Carats* of *Gold*, and ſeven *Carats* of *White*: to the *Sixteenth*, 16 *Carats* and a half of *Gold*, and ſeven *Carats* and an half of *White*: to the *Seventeenth*, 16 *Carats* of *Gold*, and eight *Carats* of *White*: to the *Eighteenth*, 15 *Carats* and an half of *Gold*, and eight *Carats* and an half of *White*: to the *Nineteenth*, 15 *Carats* of *Gold*, and nine *Carats* of *White*: to the *Twentieth*, 14 *Carats* and an half of *Gold*, and nine *Carats* and an half of *White*: to the *One and Twentieth*, 14 *Carats* of *Gold*, and ten *Carats* of *White*: to the *Two and twentieth*, 13 *Carats* and a half of *Gold*, and ten *Carats* and a half of *White*: to the *Three and Twentieth*, 13 *carats* of *Gold*, and 11 *carats* of *White*: to the *Four and Twentieth Needle*, 12 *carats* and an half of *Gold*, and eleven *carats* and an half of *White*.

CHAP. X.

One muſt alſo according to this Method make the 32
Needles: yet further, if one would do it well (but it is not uſeful) to touch the meaner *Gold* under twelve *carats*: or one might make the *Needles* from *carat* to *carat*, ſo that the half *carats* are not brought in, for they are very difficult to be diſcerned) but the *Needles* will be fewer in number: this now is left to every ones pleaſure: and theſe *white Needles* are to be uſed upon the parted and *waſhed Gold*, as abovesaid.

CHAP. XI.

CHAP. XI.

How Touch-Needles *are to be made and uſed for* Crown-Gold.

Section. 1. CROWN-*Gold* is not to be order'd like the former Additions: for the *Italian* Crowns have more *Red* than the *French* Crowns: ſo that it will be neceſſary to make to every ſort of Gold particular *Needles*: for the *French* Crowns have almoſt the half part white, (or *Silver* addition) on the contrary, the *Italian* Crowns have their addition of one part *white* and two parts *red* (though they are not all alike, for ſome part have addition almoſt the half part *white*, and ſome parts more *red* then *white*:) therefore I will here ſet down the Diviſion upon two parts *red*, and one part *white*; for, if the one ſort of Gold ſhould be *whiter* than the *Needles* (hereafter mentioned) then the half white and half red are to be uſed.

Weigh then to the *firſt Needle*, 24 *carats* of fine gold, which maketh the *firſt Needle*: to the *Second*, 23 *carats* and an half of *gold*, and two *grains* of *white*, or fine *ſilver*, and four *grains* of *red*, that is, *pure boiled copper*: to the *Third*, 23 *carats* of *gold*, and four *grains* of *white*, and eight *grains* of *red*: to the *Fourth*, 22 *carats* and an half of *gold*, and ſix *grains* of *white*, and one *carat* of *red*: to the *Fifth*, 22 *carats* of *gold*, and eight *grains* of *white*, and one *carat*, and four *grains* of *red*: to the *Sixth*, 21 *carats* and a half of *gold*, and ten *grains* of *white*, and one *carat* and eight *grains* of *red*: to the *Seventh* 21 *carats* of *gold*, and one *carat* of *white*, and

and two *carats* of *red:* to the *Eighth,* 20 *carats* and a half of *gold,* and one *carat* and two *grains* of *white,* and two *carats* and four *grains* of *red:* to the *Ninth,* 20 *carats* of *gold,* and one *carat* and four *grains* of *white,* and two *carats* and eight *grains* of *red:* to the *Tenth* 19 *carats* and a half of *gold,* and one *carat* and six *grains* of *white,* and three *carats* of *red.* CHAP. XII.

2. After this Method and Instruction one may divide the *Needles* more or less, so as they may decrease or increase from *carat* to *carat* as one pleases: These *Needles* are used not only upon the *Crown* or *Coin'd gold,* but also upon all other *Gold,* which is of such *Allay,* or have in them the Addition, after the above-mentioned Instructions.

CHAP. XII.

The Division *of the* Touch-Needles, *when the Metal is* half white, *and* half red.

Section. 1. *The fairest* Crowns *in* Colour.

BECAUSE some *Crowns* are ordered which have half *white* and half *red,* which I esteem the finest in *Colour,* therefore weigh in the division to the first *Needle,* 24 *carats* of fine Gold, as also in all the *Needles,* the highest best or first *Needle* shall be fine Gold: to the *Second Needle,* 23 *carats* and an half of *gold,* three *grains* of *white,* and three *grains* of *red:* to the *Third Needle* 23 *carats* of *gold,* six *grains* of *white*, and six *grains* of *red:* to the *Fourth,* 22 *carats* and an half of *Gold,* and nine *grains* of *white,* and nine *grains* of *red:* to the *Fifth,* 22 *carats* of *gold,* one *carat* of *white,* and one *carat*

CHAP. XII.

carat of *red:* to the *sixth*, 21 *carats* and a half of *gold*, and one *carat* and three *grains* of *white*, and one *carat* and three *grains* of *red:* to the *Seventh*, 21 *carats* of *gold*, and one *carat* and ſix *grains* of *white*, and one *carat* and ſix *grains* of *red:* to the *Eighth*, 20 *carats* and an half of *gold*, and one *carat* nine *grains* of *white*,& one *carat* nine *grains* of *red:* to the *Ninth*, 20 *carats* of *gold*, two *carats* of *white*, and two *carats* of *red:* to the *Tenth*, 19 *carats* and a half of *gold*, and two *carats* and three *grains* of *white*, and two *carats* and three *grains* of *red:* to the *Eleventh*, 19 *carats* of *gold*, and two *carats* ſix *grains* of *white*, and two *carats* ſix *grains* of *red:* to the *Twelveth*,18 *carats* & a half of *gold*, and two *carats* and nine *grains* of *white*, and two *carats* & nine *grains* of *red:* to the *Thirteenth* 18 *carats* of *gold*, three *carats* of *white*, and three *carats* of *red:* to the *Fourteenth*, 17 *carats* and a half of *gold*, and three *carats* and three *grains* of *white*, and three *carats* and three *grains* of *red:* to the *Fifteenth*, 17 *carats* of *gold*, and 3 *carats* and ſix *grains* of *white*, and three *carats* and ſix *grains* of *red:* to the *Sixteenth*,16 *carats* and a half of *gold*, and three *carats* and nine *grains* of *white*,and three *carats* and nine *grains* of *red:* to the *Seventeenth*,16 *carats* of *gold*, and three *carats* of *white*, and three *carats* of *red:* to the *Eighteenth*, 15 *carats* and an half of *gold*, and four *carats*, and three *grains* of *white*, and four *carats*, and three *grains* of *red.*

Section. 2.

After this Method you may divide the *Needles* more or leſs, or to increaſe or decreaſe from *carat* to *carat*, as you were inſtructed before.

CHAP.

CHAP. XIII.

CHAP. XIII.

How Touch-needles *are to be made for* Rhenish Gold, *in which there is two parts* white, *and one part* red.

ALTHOUGH some of the *Rhenish Gold* hath also the addition of *half white* and *half red*, to which the *Needles* before set down are to be used: Neverthelefs if the Addition be *two parts white*, and *one part red*, upon such you shall divide the *Needles* thus, 1. *The Division of Metals for Needles.*

To the first *Needle* weigh 24 *Carats* of *fine Gold*, which maketh the *first Needle*: to the *Second needle*, 23 *Carats* and a half of *fine Gold*, and four *Grains* of *white*, and two *grains* of *red*: to the *Third*, 23 *Carats* of *Gold*, and eight *grains* of *white*, and four *grains* of *red*: to the *Fourth*, 22 *Carats* and a half of *Gold*, one *Carat* of *white*, & six *grains* of *red*: to the *Fifth*, 22 *Carats* of *Gold*, one *Carat* and four *grains* of *White*, and 8 *grains* of *red*: to the *Sixt*, 21 *Carats* and a half of *Gold*, and one *Carat* and eight *grains* of *White*, and ten *grains* of *red*: to the *Seventh*, 21 *Carats* of *Gold*, and two *Carats* of *White*, and two *Carats* of *red*: to the *Eight*, 21 *Carats* and a half of *Gold*, and two *Carats* and four *grains* of *white*, and one *carat* and two *grains* of *red*: to the *Ninth*, 20 *carats* of *gold*, and two *carats* and eight *grains* of *white*, and one *carat* and four *grains* of *red*: to the *Tenth*, 19 *carats* and a half of *gold*, and three *carats* of *white*, and one *carat* and six *grains* of *red*: to the *Eleventh*, 19 *carats* of *gold*, and three *carats* four *grains* of *white*, and one *carat* and eight *grains* of *red*: to the *Twelfth*, eighteen *carats* and an half of *gold*,

CHAP. XIII. three *carats*, and eight *grains* of *white*, and one *carat* and ſixteen *grains* of *red:* to the *Thirteenth*, eighteen *carats* of *gold*, and four *carats* of *white*, and two *carats* of *red:* to the *Fourteenth*, 17 and an half *carats* of *Gold*, and and four *carats* and four *grains* of *white*, and two *grains* of *red:* to the *Fifteenth*, 17 *carats* of *gold*, and four *carats* and 8 *grains* of *white*, and two *carats* and four *grains* of *red:* to the *Sixteenth* 16 *carats* and a half of *Gold*, and five *carats* of *white*, and two *carats* and ſix *grains* of *red:* to the *Seventeenth*, 16 *carats* of *gold*, and five *carats* and four *grains* of *white*, and two *carats* and eight *grains* of *red:* to the *Eighteenth*, 15 *carats* and an half of *gold*, and five *carats* and eight *grains* of *white*, and two *carats* and ten *grains* of *red:* to the *Nineteenth*, 15 *carats* of *gold*, and 6 *carats* of *white*, and three *carats* of *red:* to the *Twentieth*, 14 *carats* and a half of *gold*, ſix *carats* and four *grains* of *white*, and three *carats* and two *grains* of *red:*

Although now the *Rheniſh Gold* uſeth not to be of ſo ſmall a content, nevertheleſs the *Needles* are thus to be made for the *Allay* or additions ſake, that one may by the *Touch* know the *Mean-Gold* by it, and judge of the neareſt Content.

Section. 2. *Needles of Copper.*

One may alſo according to this manner dreſs or order ſome few *Needles* with all *red* or *Copper*, for ſome *Golds* eſpecially they which are rich among the Coynes, (the *Hungarians* having all red :) But when one would make *Touch-Needles* upon a certain Content of *gold*, which with the addition of the *Allay* ſhould be otherwiſe than they which are ſhewn before, then they may be divided after the above-mentioned inſtruction : which you are to underſtand thus: Let the Contents of *gold* be with *Allay* or *addition*, as it will, yet order thy *Touch-Needles* thus, That alwayes *gold* and the *addition*

dition may make together a full *Mark*, as is to be ſeen in the above-mentioned inſtruction of the *Needles*. CHAP. XIII.

Section. 3. *The Diviſion to caſt together.*

When you have divided the *Needles* with diligence, then let the diviſion of every one ſeverally be put in a little *Crucible* with a little *Borax*, flow it together and when it is flowed put it quickly out, for the ſooner the diviſion of the compoſed *Metals* flow together and come out of the fire, the better it is. Some let it go together in a *Charcoal* fire, but the Diviſions remain not alwayes deft of it, and ſometimes the Coals break, and by that diviſion does come to nothing, therefore 'tis better to let it flow together in a ſmall *Crucible*, whereby there will not be ſo much care of running through.

4. *The Needels to be beaten into lengths.*

When the Diviſions are caſt together, then beat them every one ſeverally into Lengths, and form them according to thy pleaſure, beat and cut alſo upon the *Needles* the *Figures* what every one containeth of fine *Gold* and *Allay*, that one may ſee how many *carats* and *grains* of fine *Gold*, every *Needle* hath, that in the *Touch* there may be no Miſtake.

If one hath a mind he may *ſoder* together the ordered *Needles* upon *copper* or *ſilver* pieces, that only the ends may be *Golden* divided *Needles*, as alſo commonly of the Gold-Touch, and uſually Needles are made ſo, elſe they would come to much Mony, as may be ſeen by the following *Sculpture*.

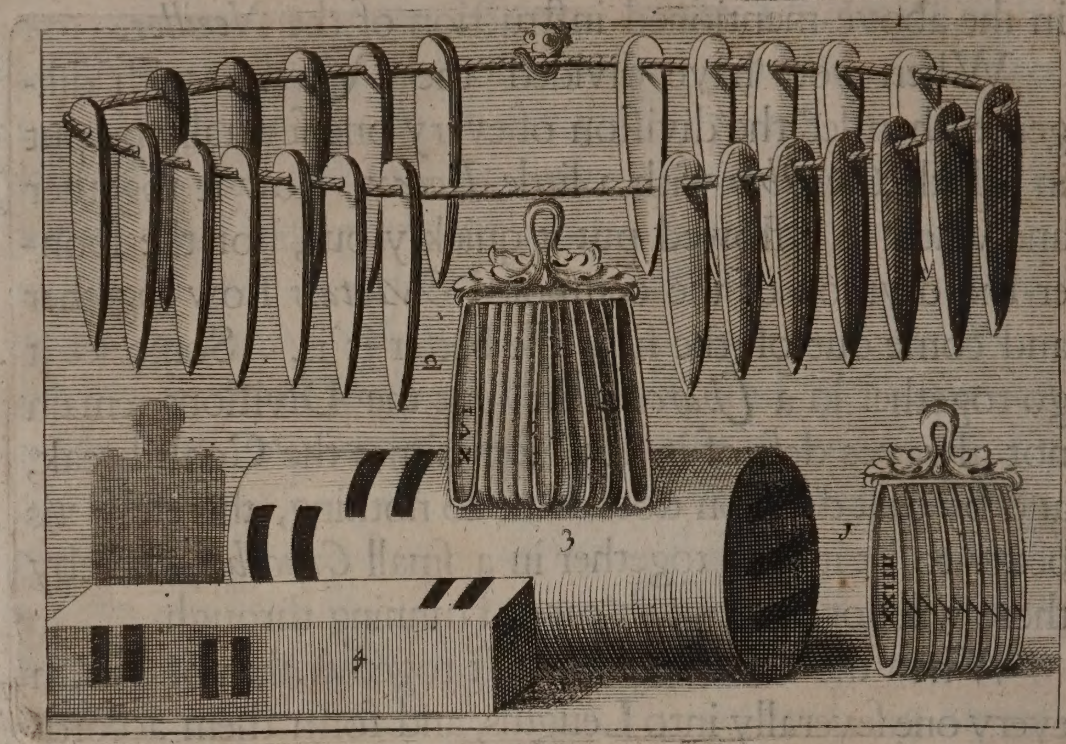
5. *The Touch Needles of the Common Goldſmiths.*

But the *Gold-Smiths* take not ſo much Pains, nor are at ſo large Expences, but cut a piece of a *Duccate* and of a *Crown*, and of a *Rheniſh Gilder*, and ſoder every on Copper piece, after this they touch their Gold: And by this they can very well ſee whether the *Gold* have its right *Content* either of Duccats, Crowns, or *Rheniſh Gold*, but if there be a different Content, then they cannot know how much properly the Content is leſs.

Sculpture,

CHAP. XIV.

Sculpture XVIII.



Deciphered.

1. *The Proportions of* Touch Needles *for* Gold.
2. *The* Ingot *to be compared with those* Touch-Needles.
3. *As also by the Touch-stone.*

CHAP. XIV.

How the Touch Needles *are to be used.*

Section. 1. *Touchstones*

WHEN then the *Touch-needles* are prepared with diligence, and one would use them, there is need of a good *Touch-stone* upon which the *Gold* is to be *touched*, of such are found some part which are *grey* and *pale green*, but the *black* ones are the best, although the same be not all good, especially, if they are either too hard or too weak. The *weak* ones have this property, that upon them no *Gold* doth touch *bright*,

bright, but the *Gold* doth only grind on it, and becometh in the aſpect *weak* and ruffe, alſo the *Hungariſh* or other weak *Gold* will not touch it ſelf right upon *Touch-ſtones* which are too hard, for the *Gold* doth run over it, that the ſtroak is not very well to be ſeen, and that *Touch-ſtone* is not good which doth not touch the *Gold*, of what Contents ſoever it be, with a fine good and ſtrong *ſtroak*, that it be bright upon it, and alſo the Touch-needles as long untill the ſame ſtroak be like the *Gold-ſtroak* in the colour, and as high: then you have very nigh the Content of the *Gold*: only, as I have given an account above, Obſerve well, whether the *Gold* be high-*grain'd*; viz. whether it hath much *Copper* added, or much *white*, which is called *Pale Gold*, according to this, uſe the *Needles*, which every one doth not underſtand, and therefore he muſt have the Knowledge of the righ *ſtroak* from great *Practice.* But as to the *hard Gold*, they do not give a right *ſtroak*, but they do *touch* all of a ſmaller content than they have in fine *Gold*, therefore ſuch *ſtroaks* are to be judg'd *falſe* and uncertain.

CHAP. XV. Section. *Ginnys.* 2. *Concerning hard and brickleGold.*

CHAP. XV.

How the Gold *is to be proved by* Aqua fortis.

1. *To cut pieces for Treal.*

IF you have Pieces of *Gold* either in *Plates* or *Ingotts*, and wouldſt aſſay them, then firſt cut *Pieces* or *Plates* above, at one end of it, and below at the other end, and beat the *Bits* thin that you may weigh ſo much as you have neceſſity to uſe for a tryal, but if it is a caſt *Ingot*, then

 beat

CHAP. XV. beat it thin only at one end, and weigh of it for thy *Tryal.*

Section. 2. *The Carat weight must be small.* To such a Tryal of *Gold* and *Gold-Gilders*, you must have a particular *Carat*-weight fitted for it, and it must be small because of the *Silver-cut*, otherwise the *Ballance* cannot carry the *Cut* (concerning which shall be treated of hereafter) the dividing of the *Carat* weight is as followeth.

Division of the *Carat-weight.*

24 Carats is one *Mark.*
12 Carats
6 Carats
3 Carats
2 Carats
1 Carat
6 Grains is half a *Carat.*
3 Grains
2 Grains
1 Grain
$\frac{1}{2}$ Grain
$\frac{1}{4}$ Grain
$\frac{1}{8}$ Grain

If you would prove the *Gold*, see if it be of a rich or poor Content, and would also certainly judge how much a *Mark* of it hath of *fine Gold,* then you must know first (and before the nearest Content of the *Gold* according to which you are to make your *Tryal*, as shall follow.) That for such contents you shall have two sorts of wayes to inform your self, First, by the *Touch* with the before made *Golden Touch-Needles*;) Secondly, One may make a nearer Trial of the *Gold*, for, although the Proof do not remain whole in the *Aqua fort.* yet you may see very near what the *Gold* doth hold

hold, Therefore it is beſt to uſe the *Aſſay-proof* upon it, by which one may alſo find, what the *Gold* containeth both in *white* or *fine Silver*. When now you have found by theſe waies the neareſt content of the *Gold*, then make the cut of *fine Silver* (which muſt be without *Gold*;) take then the *Gold* and beat it with a *Hammer* upon an *Anvil* fine and thin, and make thy cut ſo, that the *white* or *Silver*, which is already with the *Gold*) may be counted with the *Tryal* or *fourth* part (for it muſt contain three times as much *Silver* as of *fine Gold*.) To comprehend this the better, the following Example ſhall demonſtrate it, which I have found by the tryed Proof, that of the *Gold* which containeth 14 *Carats*, 8 *grains* of *fine Gold*, and 7 *Carats*, and four *grains* of white; I weigh it with the ſmall *carat* weight to two alike *half-Marks*, then there will be in every *half Mark* 7 *carats*, and four *grains* of Gold, and 3 *Carats* and eight *grains* of white, to which I add three times the weight of fine *Silver* as the *gold* containeth of *fine gold*; this is my Proportion. Now I do multiply the ſeven *carats* and four *grains* (which containeth the *half Mark*) of *fine gold*, with three, and there will come 22 *carats* of white or *Silver* to the Addition or to the *Cut*: from this I reckon, That of three *carats*, and eight *grains* of white there will be as much as the *half Mark* had of *Silver* with it before, ſo there will remain 18 *carats*, and 4 *grains*, and thus much *fine Silver* you muſt add in an half *Mark*.

CHAP. XV.

3. *Aſſay proof.*

4. *To make the Carat.*

As this *Silver* or *Cut* and the *half weighed Mark* do make together 30 *carats*, and 4 *grains*, ſo much alſo muſt be the *inweighed gold*, of the other half *Mark cut*. Put every one of theſe with its *Cut* upon a well *nealed Copel*, and add nine weights of pure *Lead* into it, let it go off together, and ſee whither the *grains* come alike, then lay one of the *grains* in the Scale, and as much

5. *The Tryal of it.*

as

CHAP. XV. Section.

as it now weigheth leſs than thirty *carats* and four *grains*, ſo much containeth a half *Mark* of *Gold - Red - Copper*, but to the *fine Silver* becauſe it looſeth upon theCopel, if it goeth off upon it with *Lead* as much as the *Lead* hath carryed away,may by a *grain weight* be accounted; for, underſtand it thus; In caſe every *grain* did weigh after it was gone, of 29 *carats*,and 4 *grains*: alſo a *grain* waſt of *fine silver*, there would be waſted one *Carat* upon the *half Mark*, then there will come upon the whole *Mark* two *carats*; thus much (*Copper* (or *red*) containeth a *Mark* of mixt *Gold*.

6. *To beat the little Rolls.*

If the *grains* are diligently drawn and weighed, then beat out of every *grain* a fine and clean piece or *Roll*, not too thin,and glow it often that it may not be *ſhivery*, and that nothing may go off; at the laſt glow the little *Roll*, and roll it gently over, that you may ſee whether by the often glowing and beating ſomewhat be come off: When now the *Rolls* are clean prepared, glow them once more, and if they from the glowing and rolling be come hard, let ſuch things be mended.

7. *Diſſolving.*

But the glowing muſt be done in a golden little half Pipkin made on purpoſe,that nothing unclean may come in it, put then the *Rolls* together in a little *ſeparating Glaſs*,put to it near ſo much *Aqua fortis* made for *Gold-proofs*, that it may go an half finger broad over the little *Rolls*, ſtop the *Separating Glaſs* above with a hard twiſted paper, that no vapors may go out, and put it thus into a little *Veſſel* of *Iron* or *braſs* made on purpoſe, over a few live Coals, that the *Aqua fort.* may begin to work, ſo will the *ſeparating-Glaſs* become brown, but let it not work too much or too faſt, yet take it a little while from the *fire*, and then put it on again, untill the *Aqua fortis* hath done its working, and the *Glaſs* become white again: Then put off the *Aqua fortis* again

again and put fresh *Aqua fortis* upon it, set it again with the Vessel over the fire, and let it work: this is done, because if the first *Aqua fort.* were grown too weak, and had lost somewhat of *Silver* by the *Rolls*, that the other *Aqua fort.* might touch it again, and make it clean. Take notice also, That you may cause the last *Aqua fort.* to work in great *Bubbles*, that the *Roles* may become very clean, and put in the second *Aqua fort.* which hath not been used, for it hath its strength as before. CHAP. XV.

Then put clean sweet warm water upon the little Rolls, (*Rain Water* is the best for it) let it stand a little, and put more warm, or rain Water, upon it again, and set the *Glasses* with the *Rolls* over a coal fire, let it boil and work in great *Bubbles*, then take it off, and casting the water again away, this do three times with warm or rain water, that the *silvery Aqua fort.* which did hang about the little *Rolls* be *dulcified*, then is it enough: When the little *Rolls* are thus clean and sweet, then put them out very gently, with the last sweet water in a glaz'd pot or glass bottle, and pour the water off from it, and take the *Golden Rolls* with clean *Pincers* out of the Pot, and put them in a clean cloth to suck the rest of the water into it, and the Rolls will look very fine and brown.

Section. 8. *To sweeten or dulcify.*

Then put them into the *Golden pott*, and after, put them into an *Assay-Oven*, but not in an exstream heating, and glow them well and they will become as fine as a *pure Gold*: When this is done, Take the two little *Rolls*, weigh them one against the other, and if they are alike in weight, then have you proved them right: next, put them together in a *weigh-scale*, and weigh them with the *Carat-weight*, and how much they do weigh, so much containeth the *Mark* (of the mixt *Gold*) in fine *Gold*: this only is to be observed, That the weight of the Wa-

9. *To neal the little Gold Rolls.*

CHAP. XV. ter, (as much as the Water hath left after it with the *Golden Rolls*) must be substracted always in the Weight from such Content. But how much there will be to substract you must search with a singular Proof, with which you use to prove the *Aqua fort.* but when you have once proved the *Aqua fort.* then you have no need to prove it any more, but may keep it for use: yet 'tis commonly found that upon a *Mark* of fine *Gold*, as from 24 *carats* you must substract one and a half, sometimes two *grains* for the weight of the water, and so you must substract according to the Example of the before mentioned Proof, as upon 14 *carats*, and 9 *grains*, as much as the Golden Roll of one *grain*, did weigh, then there will remain 14 *carats* and 8 *grains* of *fine gold*, for in the *gold proof*, in many places, one useth not to give in, in buying, a half *grain*, but in the *coin-works* they use all wayes to count, and give in the half *grain*: If then the little Rolls contain in *fine gold* 14 *carats* and eight *grains*, then a mixt *mark* of *Gold* will contain 7 *carats* and four *grains* of *white* or *fine silver* substracted.

Now, the *Gold* of 24 *carats* and 8 *grains* of the whole cut, and 24 *carats* of *Gold* & 44 *Carats* of *silver*, you shall finde (as I have said) that the Contents will be a mixt *mark*, 14 *carats* 8 *grains* of *fine gold*, and 7 *carats*, and 4 *grains* of white, and two *carats* of red, and these three Contents will make together a full *Mark*.

Section. 10. *Coyned Gold.* After this manner and method are to be proved all other *Golds*, likewise the *coyned Gold*, and one needeth not the *Assay-Proof*, in the *coined Gold*, if one knoweth the nearest Contents, but if one doth not know the Contents certain upon a *carat*, then an Assay of it must be made.

11. *To make the true Carats.* Now I use this Method in my *Cut* (and commonly on the *silver* or *Cut*) to take two *carats* or somewhat

what leſs for a tryal which doth agree with the Multi- plication (as above-heard, of the three Contents,) and it is better to take two Carats of ſilver leſs than one too much, and ſo the Rolls will remain the firmer and more intire,and there is no fear though ſomewhat of the Rolls were loſt or torn off.

You may alſo finde in a *Gold* (of which you intend to prove the *red* and *white*) that if you make the Aſſay-Proof, (as above demonſtrated) then cut one *Mark* of the Gold more, and put it with its due of *Lead* without any other *Cut*) upon the *Coppels*, and let it go off with the *Try-proof*, then weigh the ſame *Grain*, and you will ſee what is gon off,and how much it comes out lighter, ſo much hath been *red* with it. 12. *Another way to find red in Gold.*

Thus you have the right and clear Inſtruction for *Gold Proofs*, and if you will follow it, you will do well, and thereby not be apt to err in your proofs.

CHAP. XVI.

How to prove the Aqua fort. *and how much* Gold *it doth leave in the* Proof.

ALSO, if thou wilt prove an *Aqua fort.* how much is ſubſtracted in the *Gold-Proof*, Take *Gold* which is caſt divers times, through *Antimony*, and is brought to the higheſt; and make the proportion upon 24 *carats*, and weigh it alſo in two half *Marks* (as you have been inſtructed before) and multiply it by 3, then there will come upon every half *Mark* of fineGold 36 *carats* of fine Silver, then put every half *Mark* of its propor- tion 1. *The manner of Trying it.*

CHAP. XVI. tion by it ſelf, upon well neal'd *Coppels*, let it go off together, weigh the grains off, and ſee whether they come alike, and beat them in ſlender *Rolls*, and put them into ſeparating Glaſſes, and put upon them ſo much *Aqua fort.* as one doth uſe to take to a *Gold-proof*, as hath been ſhewn before in the *Gold proof:* then place it with an iron Trevet over a little Coal-fire: Let it diſſolve, and put upon it the Second time freſh *Aqua fort.* ſet it over again; when now it is right, and well diſſolved, pour the *Aqua fort.* on it, and make the Rolls with warm vvater very clean, and dry them, and glovv them in a little melting pot for *Gold*, and they vvill become fine, then weigh them one againſt the other, and if the *Rolls* be alike then the Proof is right; then lay them together, and againſt it thy whole *mark*: (after you have weighed it) and as the *Golden Rolls* do come out heavier, ſo much is to be ſubſtracted in the *Gold-proof* upon this one *Mark* of fine *Gold.*

Section. 2. *Another way.*

Take this for an Example: I have weighed in two *half Marks* upon one *Mark* of fine *Gold*, and have parted it vvith the *Aqua fort.* (as above is mentioned) and after the diſſolving, dulcifying and glowing, then the two little *Rolls* have weighed one *Mark* or 24 *carats* and one *grain* and a half, ſo that the *Aqua fort.* hath left behind two *grains*, in the Proof, thus much is to be ſubſtracted in this *Aqua fort.* upon 42 *carats*.

3. *What the Remainder is.*

Know alſo that ſuch as is kept back in the *Aqua fort.* is nothing elſe but *ſilver* which the *Aqua fort.* could not draw out ſo clean, by which the *Gold* doth not become ſo very clean and fine, which is to be ſeen. If one letteth the *Golden* part go off with a little clean *Lead* upon a *Coppel*, to ſee how they become ſmaller or retain their weights. But if the *Aqua fort.* do leave its ſtrength or ſpirits with the *Gold*, (as ſome do think) then the ſame could not remain nor conſiſt upon the *Coppels*.

Out

Out of which may be concluded, That by *Aqua fort.* fine *Gold* is made: But this is ſure, That a good and well purified *Aqua fort.* bringeth the *Gold* in parting (eſpecially if the *Gold Calx* (as ſhall follow) hath been cleanly dulcified) to 23 *Carats* and 11 *Grains*. But it is not yet quite *fine Gold*, for the remainder with the *Gold* is nothing elſe (as is ſaid before) than *Silver*: (as well in the parting the *Gold*, as in the Proof) elſe one may drive away what is left with the Bellows, and make it clean. Chap. XVI.

Section. 4. *Rules for it.* But if you have no *fine Gold*, to the Proof of the *Aqua fort.* then take *Hungariſh Gold*, whoſe Content you know certainly, and make of the ſame Content the Diviſions and Proportions, then you may find what is to be left behind of the *Aqua fort.* and how much is ſubſtracted of it: But the *Gold* which is caſt through *Antimony* (as is before mentioned) is for ſuch uſe much ſurer and better: And know, That the ſame *Aqua fort.* after the Diſtilling muſt be purified and ſettled, before you do prove or uſe it to the *Gold-Proof*, of which afterwards an Inſtruction ſhall follow.

5. *Separating Glaſs, and other Glaſs Inſtruments* To all ſuch proving you muſt have clean *ſeparating Glaſſes*, *Tunnels* and little *glaſs Pots* for *Gold* to *ſweeten* in, theſe are to be made of good *Venetian* Glaſs, and the brighter, whiter and clearer they are, the better it is, that the proofs may well be ſeen in them.

6. *An Inſtrument for the Separating glaſs.* But the *Iron* or *Brazen* Inſtrument, upon which the little ſeparating Glaſs muſt *ſtand*, is to be made four footed, that it may ſtand faſt, and alſo with a little handle, by which it may be taken off, likewiſe another little foot or inſtrument of *Copper* or *Iron*, which muſt be flat, upon which is to be ſet the Golden little *Pots* (if one will have it ſet in the proof-*Oven* for the out-glowing) becauſe this Proof is the fineſt, moſt glorious and lovely, therefore all

CHAP. XVII things pertaining to it must be made and prepared with all diligence and cleanliness.

CHAP. XVII.

How Silver *is to be proved for* Gold.

Section. 1. *First Tryal.* THAT I may not mix the Proving of Metals together, but give to every proof its due, and to write of every one apart, how it must be done: Know then if one would prove a *goldish silver* upon *Gold*, it must first be proved upon *fine Silver*, that one may find the right Content, both of the *fine Silver* and also of the *fine Gold*: Therefore when it is proved upon the *fine* (as I have taught in the *Silver proof*) then take the same *proof Grains*, beat them thin, glow them, and weigh a *Mark* of it with thy *Penny-weight*, and dissolve the *Silver* in a little separating *glass* in *Aqua fort.* then there will remain a brown *Gold-Calx*:

2. *To dulcify it.* pour off the *Aqua fort.* very gently, then take warm sweet water (as you have done before in the *Gold* Proof) and put it upon the *Gold-Calx*, and let it boil over the Coal-fire in a little *Culbe* or bottle: now when the *Gold Calx* hath setled it self again, then drain the water off, and put upon the *Gold Calx* two or three warm waters more, that thus the *silvery* water may be clean taken off from the *Gold Calx*, then put the *Gold Calx* clean out of the *Culbe*, into a glass pott, that nothing may remain, then drain the water very clean off from it, and bring the *Gold Calx* in the *golden little Pot* clean together, and if there be wetness about the *Gold-Calx*, then press it with a clean little cloth where 'tis made moist, and gently on the

the end of one ſide, that the *wetneſs* may be ſuck'd in (only touch not the *Gold Calx* with the Cloth.) CHAP. XVII

When this is done,then ſet the little *golden Pot* upon the *Trevet* in the *Aſſay Oven*, but not ſuddenly (that the Gold may not leap, and the proof become falſe)and glow out the *Gold calx*, ſo will it become fair, then put it again out of the *golden little Pot* into the inward Scale of the *Proof-Ballance*,and ſee how much it weighs according to the divided *Penny-weight*, with which you have weighed it, ſo you will have the Content; now how much a *Mark* of *Silver* containeth, I put this as an Example, for I have proved, That a *Goldiſh ſilver* or *grain'd Gold*, of this mixt *Mark*) hath contained 14 *loths* and *a dram* of fine *Silver*,and ſuch fine *Silver* hath in a dram a *penny-weight* of *Gold*, then the Content in the *GoldiſhSilver* upon a *Mark* doth ſignify that it doth contain 13 *loths*,3 *drams*, and *three peny weight* of fine ſilver, and one *dram* and one *peny weight* of *Gold*. Section. 3. *To glow.*

Likewiſe in this manner one may alſo prove the fine *Gold* which is come from *grained Silver*, if one doth weigh a *Mark* of it, and diſſolve it, and if the fine *Mark* in ſuch a proof do contain one *dram*, one *peny-weight*, and one *Heller* of *Gold*, and is the Contents: and if a *Mark* of the *grained Silver* containeth 14 *loths* one *dram* be reckoned upon *fine Silver*,then the *Mark* will ſignify one *dram*, one *peny*, one *heller* of *Gold*, and of ſuch proof it is counted, that by it the *Gold* is found a little leſs than the former, but I leave it to every ones pleaſure to try and judge. 4. *A Second Tryal.*

Some *Aſſayers* have this Method, when they would prove a *goldiſh grain'd Oar* for *Silver* and *Gold*, then they weigh the grain'd Metal with their penny weight, and prove it upon *fine Silver*, (as 'tis uſual) and they weigh in a grain ſuch grain'd Metal after the mentioned weight (as at firſt) and diſſolve it raw in *Aqua fort.* 5. *A third way.*

and

CHAP. XVI. Section. 6.

and as much then as they do find in *Gold*, they substract it from the *fine-Silver*, and this they count for the right proof to prove *Silver* upon *Gold*.

Difference of the Proof.

But that one may know that this their *Proof* is falſe and unjuſt, although ſomewhat more of *Gold* is to be found by it, therefore I will ſhew ſome Reaſons why the ſame Gold is not ſo high in Fineneſs as the Gold which is ſeparated out of the *Proof* of the *fine Silver* by *Aqua fort.*

Firſt, although the *Copper* doth diſſolve, yet the green *Coppery water* ſets it ſelf rather on the *Gold* than on the *ſilvery water*, and then the *Copper* which hath ſet it ſelf cannot be brought off again ſo clean from the *Gold*, as from the tender *ſilvery-water.*

Secondly, *Gold* cometh higher out of the ſeparation than when the *ſilver* is *Coppery*, upon which the *Aqua fort.* doth not work ſo eaſily, as on the *fine Silver:* Therefore no *Separater* of *Gold* doth take upon him to ſeparate ſuch *Silver* after ſuch proof, but all the *Silvers* which he ſeparates in *Aqua fort.* muſt firſt be burnt upon a *Teſt.*

7. *A Singular Diſſolving.*

Thirdly, Although the firſt Proceſs to prove the *Goldiſh Silver* upon *Gold* is the common way, and alſo the right Proof, by which the true Content is to be found. Nevertheleſs, I muſt further mention a *ſingular proof* (which is found upon ſuch *goldiſh ſilver* and *grain'd* Work) by which, in the diſſolution the little *grains* or ſmall *cut pieces* of *Silver* will remain whole in the *Aqua fort.* (of what light Contents ſoever they be of *Gold*) and how ſmall and ſubtil ſoever the *grains* be: alſo that one may number all the little *grains* of *Gold* after the number of the little pieces of *Silver*, how many there be laid in the *Aqua fort.* and no ſplitting will go off from it (as in the other proofs) yet if the *grains* ſhould be weighed in, (alſo raw) the *Gold* will remain the better

ter whole, but this proving is to be done thus, when you have weighed off the *Silver* put upon it a very weak *Aqua fort.* which the *Silver* cannot well touch, and put it in a *Culbe* to dissolve over a little Coal-fire (as is usual) and let it be very hot, that the *Aqua fort.* may work with great Bubbles, and almost boyl over, this dissolution do, so long until thy inweighed *Silver* be almost dissolved, but that it may have the better help, put (if the *Silver* be dissolved) a little more than half of new and a somewhat stronger *Aqua fort.* into the *Culbe*, and the *Silver* will dissolve it self clean out, and will split no more, although the second time, there be put to it, the stronger *Aqua fort.*) but what it doth will be done at first. Chap. XVIII

This is a fine way through which the Gold remaineth together in *grains* close, but 'twill have somewhat more time than the other common proof: there are also other wayes to such proofs, as follows.

CHAP. XVIII.

To prove Goldish-Silver by the Water-weight.

I MUST further signify, That the old *Artists* have also proved the *Silvers* through common *flowing Water*, and known in the Weight, whether they have been rich or poor with Gold, This their Invention, because it proceedeth from natural *Reason*, doth please me, and is an inductive Meditation to many other serviceable things: Now the Water-weighing with the *Silver* is done thus, Take a *Ballance*, and put in one of the *Scales* Section. I. First Way.

CHAP. XVIII ☞ the *Goldish-silver*, and in the other *Scale* so much *Silver*, (which containeth no *Gold*) as that they may be equal weight, then let down both *Scales* just together into a Vessel full of clean water, so you shall find and see clearly that that *Silver* which is *Goldish* shall have in the water greater weight, but not so much as the *Silver* which hath *Gold* with it. The Reason of this Difference, is because the *Gold* in a like greatness excelleth all other Metals in weight, and is the heaviest Metal; Therefore such (as every one himself may judge) cannot swim so easily in the water, but must much sooner sink down on the ground, than they which are lighter: as the like is to be seen in the *Lead*, which goeth much before *Tin* and other Metals in the Water.

Section, 2. *How the Gold is to be found by the Water-weighing.*

But that I may give the Reader to understand, That 'tis possibly by such *Water-weighing* to reckon how much may properly be in the *Silver*, therefore know that such (in my thoughts) may be done and found out in this following manner.

First, Take *fine grain'd Silver* which is without *Gold*, lay to it good pure *Gold*, put it in one of the *weigh-Scales*, and in the other *Scale* lay fine *grain'd silver* also, so that it standeth just even: then sink both together in the water, and so much as the *Silver* goeth before with the *Gold*, so much you must supply with *good Gold* to the *weigh-Scale* in the vvater, then take the *Ballance* out of the water again, dry it well, and weigh it, and take so much from the *Silver* as the *Gold* hath drawn to it in the water, until the *Ballance* standeth even in *Æquilibrio*, then sink it in the Water again, and supply again the difference with *good Gold*, and then take off from the *Silver*; this do as long until both *weigh-scales* stand just (both within and out of the water) then you shall find that in one *scale* will lye so much *Gold* as in the other: and by this way (if you do it

it carefully) you may alſo prove in weighing a *goldiſh ſilver*, whoſe content you did not know. Chap. XVIII

Secondly, The *water-weighing* may alſo be done by *Arithmetical Proportions*, to which the Demonſtrations will be ſerviceable,but they are not to every one known, namely thus, That if the *Gold* (as I have tryed it) weigheth againſt the *ſilver* in a like quantity 405 *Marks*, and 8 *Loths*, and the *fine ſilver* alſo the like quantity with the *Gold* two hundred twenty ſeven *Marks*,4 *Loths*; this obſerve well, Then take the *ſilver* vvhich contains *Gold*, lay it in one of the *weight-ſcales*, and weigh it againſt the Weights which are made of pure *ſilver*, that you may know the weight to be proper, then ſink them together into the water: now, as much as it doth go for the *Goldiſh ſilver*, ſo much you muſt ſupply of with the *ſilver weights*, then make an account and obſerve the Proportions how the *Gold* and *Silver* ſtand together, as you have been inſtructed before, and I doubt not but you may come to a right proof by this Example. Section. 3. *Arithmetick.*

CHAP. XIX.

To find without ſuch water-Proof, *whether* Silver *contains* Gold.

BECAUSE the Metals have divers Quantities of like greatneſs, one againſt the other (as has been ſpoken of the *Gold* and *ſilver*) if then you would know and finde the difference of the mixture in the *Goldiſh ſilvers* you muſt draw the *Gold* through an Iron plate wherein an hole is made, into which a thin and ſubtil wyer is to be put, and do the 1. *Firſt Way.*

CHAP. XIX.

the good *ſilver* alſo through the ſame hole, then cut a piece of both, equally in one length as near as poſſible, and weigh one againſt the other with a *Proof-weight*, upon a quick *Ballance*, and ſo you will ſoon finde the difference betwixt the *Gold* and *Silver*. Now, if you have a *Goldiſh-ſilver*, and do draw it through the mentioned *hole*, and doth take the right length of it, like the aforeſaid former Wyer,and doth weigh it likewiſe upon the proof-*Ballance* againſt the *ſilver-Wyer*, then you will finde a difference in the weight,out of vvhich you may count the weight of the *Gold* (as much as is in the wyers which you have weighed) then alſo weigh ſuch with the proof - weight, how much it weigheth, and you may compute (after this thy Account) how much *Gold* is in the whole weight of the *Goldiſh-ſilver*.

After this manner all other *Metals* may alſo be proved and accounted, becauſe they have one againſt the other divers Quantities in like Greatneſs: likewiſe in the *coyn'd Money*, if it be drawn to a Wyer (in the ſame thickneſs with the Wyers before mentioned) you may find in it the *Copper* and fine ſilver by this Rule.

Section. 2. *The ſecond Way.*

Alſo, this I would not leave unmentioned, as an Inſtruction for further Conſideration, and it is neceſſary to be known, That there is a difference in weight, betwixt *Tin* and *Lead*,if they be mixed together,as alſo in other Metals,which I have found in my diligent ſearching; For,one *Copper* againſt another,and one *Tin* againſt another, hath a difference alſo in the weight, elſe I would have proceeded further and ſurer with ſuch reckoning.

CHAP.

CHAP. XIX.

Sculpture XIX.



Deciphered

1. *How the* Assayer *stands before the* Assay-Oven *to prove* Metals.
2. *The Iron on which the Proof is to be cast.*
3. *A wooden Instrument to see through into the fire to prevent hurt to the Eyes.*

Chap. XX. 4. *A ſeparating* Glaſs *for proving* Gold, *placed on a little foot.*

Weigheth 5. *He that waſheth the* Goldiſh Silver *in water.*

6. *The* Block, Hammer *and* ſtool.

CHAP. XX.

How to ſeparate Gold *and* Silver, *and how to burn or diſtil* Aqua fort, *and prepare Inſtruments and Clay for the Work.*

Section. 1.

NOW, in reſpect that to the *Burning* of *Aqua fort*, there belong many Preparations, it is neceſſary that of ſuch I write ſomewhat, and ſignify the ſame: Wherefore, I will firſt ſpeak of the *Clay* wherewith they uſe to *Lute* the *Helms* and *Receivers*, and to coat the *Separating Glaſs* which ought to be prepared thus; Take good ſound and ſubſtantial *Clay*, waſh it in water that the ſtones and the courſe ſand may come off, make it into Balls, and dry it well in the Sun; Of ſuch waſh'd *Clay* take ten parts, and two parts of waſh'd *Aſhes*, three parts of clean Stone-*Horſe-dung*, one part of the *ſcales* of *Iron*, and two parts of *Cow-hair* beaten well, and mingle all theſe together, and moiſten it with warm *Oxen* or *ſheeps-blood*, and whilſt it is warm, work it with an iron *Inſtrument*: one might alſo take, among this *Clay*, *Venetian Glaſs* beaten ſmall, but not too much: and with this *Clay* one may lute-over the ſeparating Glaſſes and the great Glaſſes, in which the *Aqua fort.* is to be diſtilled, ſuch as will hold in the fire: it may alſo ſerve to joyn together the *Ovens* which are called *Athanors*, be-

The Clay.

because it holdeth faſt, and doth neither break nor crack. CHAP. XX.

But the *Clay* and thin mixture with which one uſeth to lute over the *Joynts* of the *Helmets* and *Receivers*, is is to be made thus, Take the white of *Eggs*, as many as you think fit, beat them well, in a *Peuter diſh*, and take a clean *ſpunge*, and preſs the clear of the Eggs into it, by ſqueeſing it out of the *ſpunge* into the *diſh*, and do this until it becometh clear like Well-water, then take *Mill-duſt*, 4 Loths, *Bole Armoniak*, one Loth, *white dryed Cheeſe without Cruſt* or *rind*, two Loths, and of *Sanguis Draconis*, one Loth; Grind all theſe very ſmall, and ſift them through a hair Seeve, mingle theſe with the whites of the *Eggs*, and with it, *Lute* over the *Joynts*, which you muſt underſtand thus, That ſuch Joynings be firſt with the above-mentioned *Clay* luted over and dryed well again, then this thin mixture is to be put upon a little cloth and laid over it, and let it dry of it ſelf, but this ought to be done before you bring it into the warmth, or makeſt a fire to it, then ſuch mixture will hold faſt, and the ſpirits will not go through, but if the *Joynings* ſhould afterwards let the *ſpirits* go out, then do it over in the heat with *Tallow*, vvhereby the *Clay* will become *hard* and faſt. Section. 2. *To lute the joynings.*

Here followeth another *Clay* wherewith to *lute* or *glaze-over* the *Culbs* or *bottles*, which will endure the fire, Take a good waſh'd dry *Clay*, a little *Dragons blood* and *Bole Armoniak*, and add to it a third part of *Potters clay*, & a third part of a half part of *Calx vive*, make each apart into Pouder, and moiſten it with the white of *Eggs*, as is taught above, or with warm *Ox* or *Sheeps*-blood, add to it ſo much *flox* of woollen *Cloth* or wooll ſhav'd or ſhorn, as of the *Bolus*, mingle all well together with a ſtick or wand, and with it lute over the *Glaſſes*, but not thick, alſo lute over the joynts with it, and this vvill hold 3. *Another Clay to bodies.*

CHAP. XX. hold faſt in the fire. Likevviſe other *Clays* are to be uſed to lute-over, which do alſo hold well: But becauſe theſe now mentioned do ſuffice, I have omitted for brevity ſake to ſet down others: therefore every one may try which are the moſt ſerviceable unto him.

Section. 4. *Venetian Glaſs.*

The *Glaſſes* or *Bottles* in which one uſeth to ſeparate, and in which they put *Aqua fort.* are to be made of good *Venetian Glaſs*, of an equal thickneſs in the midſt, for if they be made too ſtrong or thick of *Glaſs*, they will not hold well, but they which have a right equal thickneſs, and are not ſtrong will endure the fire the better, but if the *Glaſſes* be made of other *Glaſs*, then the *Aqua fort.* will work on them, and they are ſubject to break the ſooner, by which there cometh *dammage*, and they will be alſo dark and pale.

5. *To prepare Jugs and Retorts with ſaw-duſt.*

One may alſo cauſe *Juggs* of *Potters*-work to be made for Diſtilling *Aqua fort.* or mixing *Clay* with *Bran* or clean fine *Sawduſt*, this therefore is done, That when the *Juggs* are made and burnt *raw*, that the *Bran* or *Saw-duſt* may burn out, and then to *glaze* ſuch over ☞ with *Venetian glaſs* within and without, that the *Glaſs* flow into the *holes*, out of which the *Bran* and *Sawduſt* is burnt away, whereby they will prove very firm and hold very well in the fire, of ſuch ſtuff very good *Retorts* are made, which will not break in the fire, but are much better to uſe than the over-luted *Glaſs bottles*, therefore ſuch ſtuff is very convenient to uſe for *Retorts*: But how great the *Juggs*, *Glaſſes* or *Bottles* muſt be, I conceive, that every ones *Work* will teach what he may make according to it, for if one hath much *Aqua fort.* to burn at once, then it will require a great *Jug* or *Retort* for it, in which the *ſtuff* is to be put, and alſo the *Recipient* muſt be the bigger.

6. *Iron jugs.*

Alſo 'tis in uſe to burn *Aqua fort.* in *Iron Jugs* which are of two pieces, and can be done aſunder, whoſe form

you

you will see in the next *Sculpture.* In such a *Jug* one may set in more at one time than in a *glass-bottle*; also they need not fear the breaking of such *Jugs*, or that the stuff will be spoil'd in it; and the *Gold* hath been of a better colour by such *Aqua fort.* made in *Iron.* CHAP. XX.

For this and other Reasons, I judge it to be better alwayes to burn *Aqua fort.* in such *Iron Jugs*, than in glaz'd *Bottles*, which can but once be used, the bigness of which must be as one may put in near 20 pounds of stuff at once, but if one would burn less, the Opportunity will shew it self, how to proportion it, but for strength it must be the thickness of a finger, so it will endure the longer.

Section. 7. *Luting the* Jug.

If now one will burn *Aqua fort.* in such *Jugs* then must the joynings be well luted over, that no spirits may go out, *lute over* also the Jug without, with thin *Clay*, that the fire may the less hurt it, and lay before it a *Recipient* of Glass, but of such a bigness that the mentioned spirits may have room enough in it, and that such may not break out of necessity or force, by which there will be dammage.

8. *To gain the* Caput mort *out of the* Jug.

After the vvork is finished then must the *Jug* be suffered to *cool*, and put water in it, then will it mollify the *Caput Mort.* put it out gently with an *Iron*, and so the *Jug* will become clean again.

The form and likeness of such separating *Glasses* and earthen *Juggs* you may see in the following *Sculpture*, thus

Deciphered.

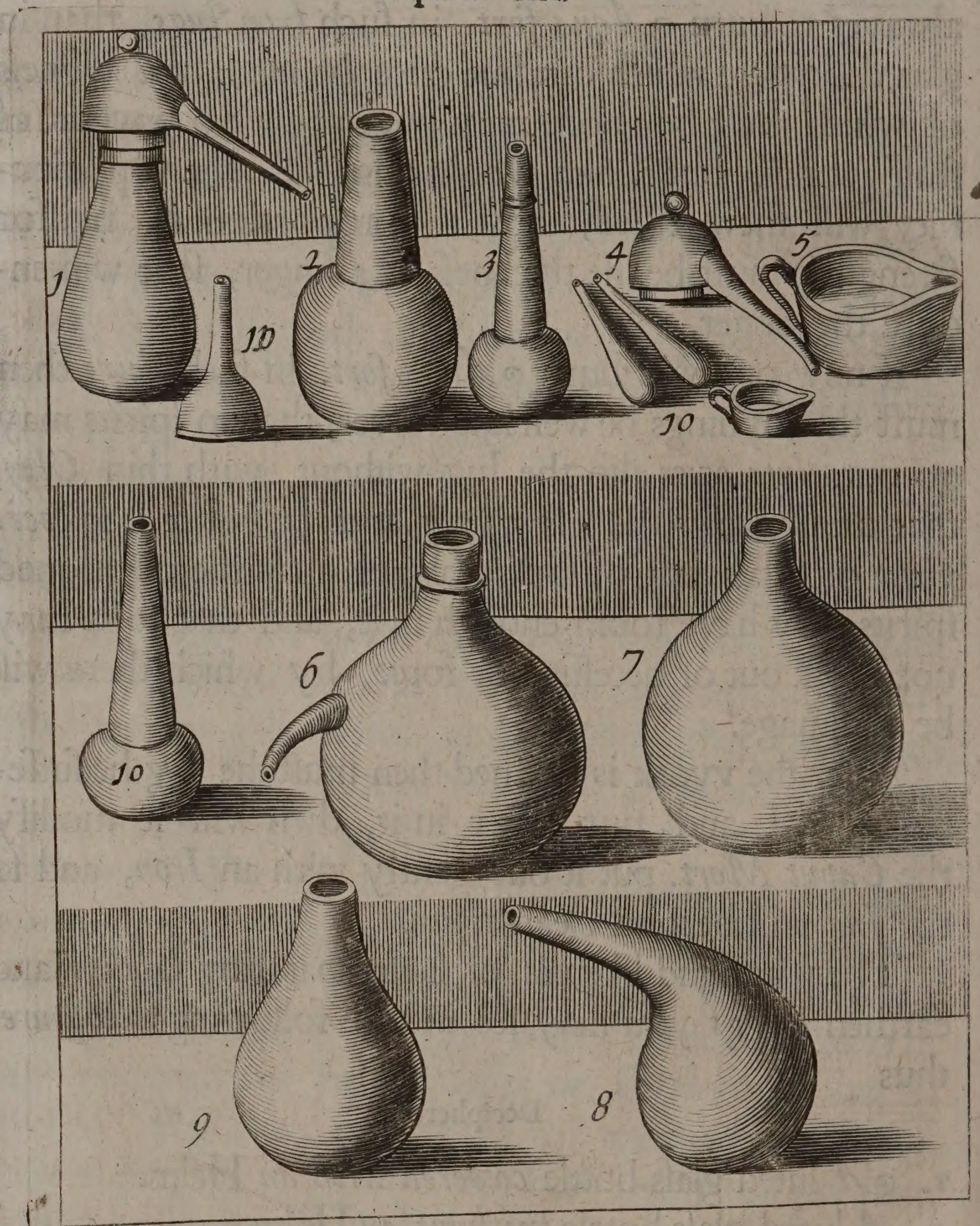
1. *A* luted glass-bottle *covered with an* Helm.
2. *A* luted glass-bottle *without an* Helm.
3. *Another* sort *of* Glass-bottle.
4. *The* Form *of an* Helm.
5. *An half* Glass, *or half* * *Pipkin with one Ear, and a Mouth.*

* Absfuzchal

CHAP. XX.

6. *A* Receiver *with a* Pipe.
7. *A* Receiver *without* a Pipe.
8. *An earthen* Retort.
9. *An* earthen Jug *or* Culb *to burn* Aqua fort.
10. *Other kind of* Bottles, *Glasses, half-Glasses, Tunnels.*

Sculpture XX.



CHAP.

CHAP. XXI.

CHAP. XXI.

How to make Ovens *to Distill* Aqua Fort.

SVERY one uſeth to prepare the *Ovens* to the diſtilling of *Aqua Fort.* according to his pleaſure: But there is one Form much better, and more profitable than the other (as I have ſeen and uſed many my ſelf) for I finde, That the *Ovens* called *Athanors*, which, as in the following *Sculpture* is properly delineated, are the beſt to be uſed to diſtil *Aqua fort.* and they are to be formed thus, Make a *Steeple* in *ſquare* or *round* four Ells high, and below in it lay an *Iron Grate*, under vvhich muſt be a Wind-hole, according to the demonſtration in the next *Sculpture:* and then make again on both ſides of the *ſteeple*, in the ſame wideneſs, according to the height of the *Juggs* or *Glaſs-bottles* round or ſquare *Ovens*, in which the *Glaſſes* or *Juggs* may ſtand: Put alſo below in the *ſteeple* or *tower*, *Iron-Grates*, ſo that it may have *wind-holes* below: in ſuch *By-Ovens* muſt be left *holes* from the Tower, that the heat (as you ſhall hear) may come out of it, and if they are about a large ſpan wide, and four fingers and a ſpan high, then are they wide and high enough: only obſerve, That when you do ſet up the high *Tower*, you do not make it two thick near to the *holes*, but rather narrower, that the fire or heat may go the better into the *By-Ovens*, then cauſe to ſuch holes, through which the heat doth paſs, fit Inſtruments of *Potters-work*, with which you may govern the fire as you pleaſe.

Section. 1.

2. *Athanor.*

Some

CHAP. XXI. Section. 3. Some cause such Instruments or *Registers* to be made of strong *Iron*, but they are not so good as the earthen, for, if the *Iron* one become hot and glowing, then they give likewise great heat, and if they are drawn before the fire, then they cannot well be managed or govern'd by it, and there is also danger therein.

4. Further, you must also have to every *By-Oven* (in vvhich you set the *Jugs* or *Glass-Bottles*) covers made of Earth or *Potters-clay*, which must be cut out also, that they close just on the neck of the *Jug* or *Glass-Bottle*, and that the Ovens may be shut very close, and leave Air-holes through it (being called *Registers*) and have Pins of Wood which go in very close to govern the Fire by it, as you may see in the eighth figure of the next *Sculpture*. Likewise upon the *Tower* a cover is to be set, which must be so large that it may cover all the upper *holes* of the *Tower*; and so is the Oven or *Athanor* prepared to distil the *Aqua fort*. But how it should be governed with the *Wind-holes* followeth hereafter in the next *Sculpture*

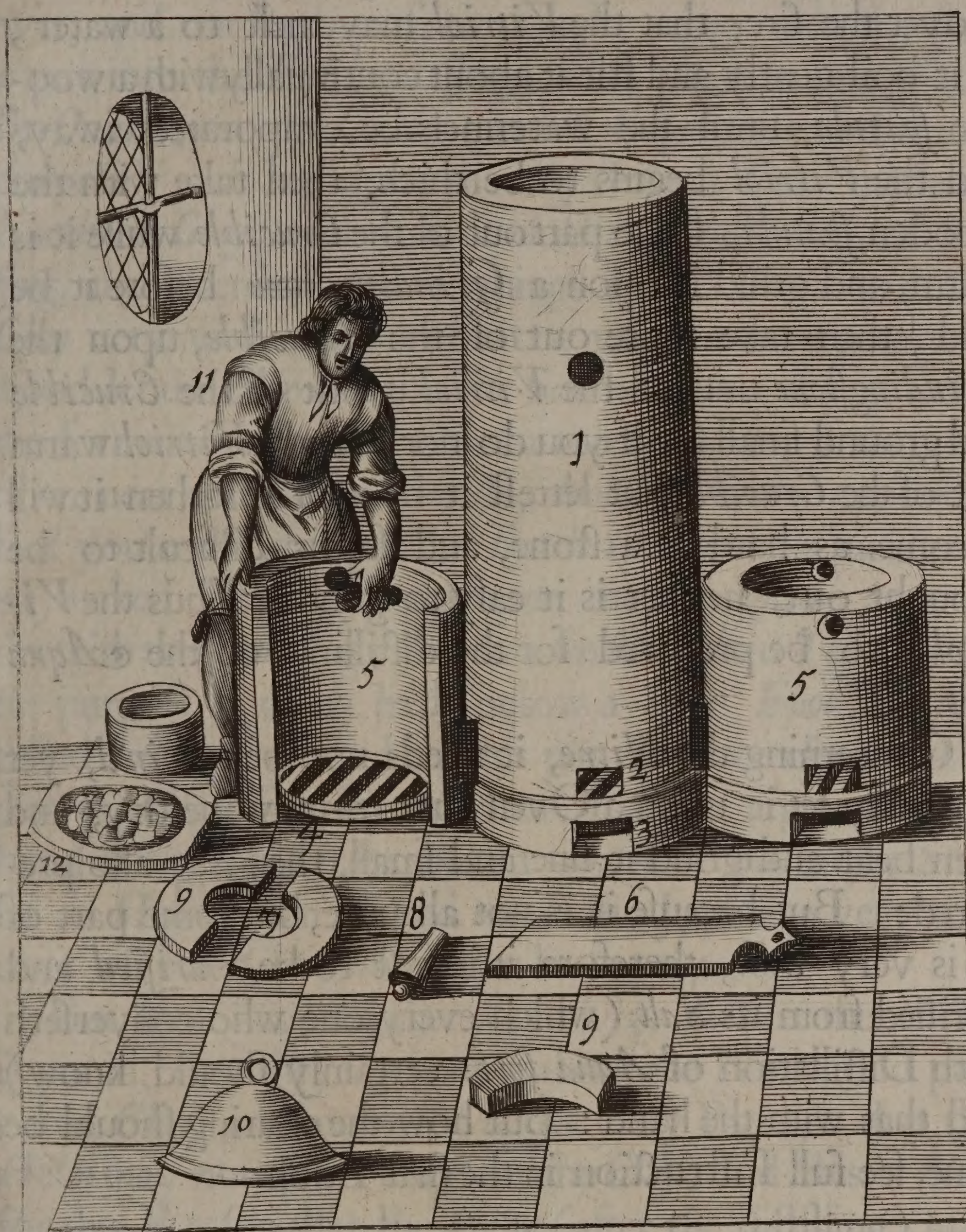
Deciphered.

1. *The* Athanor.
2. *The* Mouth-hole *over the* Grate.
3. *The* Mouth-hole *under the* Grate.
4. *The Grates in the* By-Ovens.
5. *The* By-Ovens.
6. Instruments *to open or shut the* By-Ovens *Mouth.*
7. *A Cover for the* By-Oven.
8. *The* Pins *for the Registers or Wind-holes.*
9. *A Semicircle piece of Wood by which the* Athanor *is to be made round.*
10. *The Cover for the* Athanor.
11. *The person that tends them.*
12. *A dish of* Metals *to be used.*

Sculpture.

Sculpture XXI.

CHAP. XXII



CHAP. XXII.

How the Ingredients *are to be prepared for* diſtilling *of the* Aqua fort.

FOR *diſtilling* of the common *Aqua fort.* there are uſed only two *Ingredients, Nitre* and *Vitriol*, which muſt be prepared before they are put in: firſt, the *Vitriol* muſt be *calcined* which is to be done thus, Take at once four pound of thoſe Ingre- Section. 1. *Calcining of Vitriol.*

Chap. XXIII. Section. 1. dients, and put them in an earthen glazed *Crucible*, ſet it over the fire, that the *Vitriol* may melt to a water, let it boil gently, and ſtir it about continually with a wooden *ſpatula*, until the waterineſs be evaporated away, and the *Vitriol* begins to be thick, then take with the wooden *ſpatula*, ſome part out of the *Crucible* while it is warm, and grind it upon a *Grinding-ſtone* before it be cold, then take more out of the *Crucible*, upon the *Grindingſtone* until all the *Vitriol* is out of the *Crucible* and ground ſmall, for if you do not take the *Vitriol* warm out of the *Crucible*, but letteſt it be cold in it, then it will become as hard as a ſtone, and ſo 'tis difficult to be brought out, neither is it eaſy to grind: Thus the *Vitriol* is to be prepared for the diſtilling of the *Aqua fort.*

1. *Calcining of Vitriol.*

2. *Salt-Petre.* Concerning the *Nitre*, it needs not be *calcin'd*, yet one may ſet it upon a Oven that it may be dry, and then beat and grind it fine and ſmall, then is it alſo prepared: But becauſe it is not all pure, but ſome part of it is very *Salt*, therefore it is firſt to be *clarified* and purified from its *Salt* (which every one who converſeth with Diſtillation of *Aqua fort.* certainly ſhould know) and that with the hand: But how the clearing ſhould be done, ſee full Inſtruction in the firſt Book.

CHAP. XXIII.

How Aqua fortis *is to be* diſtilled.

1. *In a Glaſs Body.*

TAKE four pound of clean *Nitre*, and three pound and a half of *calcin'd Vitriol* (as is mentioned) grind them very ſmall, and put them in an *over-luted Glaſs-body* (bruſh'd with an Hares-foot bound to a little ſtick) the neck of the Bottles

Bottles being taken off, that the water may go clean over, and not have cauſe to aſcend, when then the *ſtuff* is put into the *Bottle* or *Jugg*, then put it in one of the *By-Ovens*, on the *Grate* (with a *Copel* made for it on purpoſe) and lay upon the *By-Oven* a Cake made of *Earth* or *Clay*, and daub it cloſe about the neck of the *Jug*, and over-lute the joynings every where with the *Clay* very well, that no heat or vapours may go out of it, and let the *Air-holes* on the ſide be open (as you ſee in the former *Sculpture*) yet not too wide (for if they are open near three fingers wide, then 'tis wide enough:) But you muſt not put the *Bottle* (as now 'tis mention-ed) naked into the Oven upon the *Iron-grate*, as you do with the *Iron Jug*, but in a ſmall earthen *Teſt* (made on purpoſe) which hath below a little *Foot* which is called a *Coppel*: and in this put aſhes or clean *Sand*, that the *Glaſs* Bottle may come to ſtand a good ſquare hand above the *Grate*: when you have put in the *Stuff* ſet an *Helm* upon it, and dawb the Joynings very well over with the *Clay*, which you have prepared.

CHAP. XXIII. Section 2. Copels *to burn* Aqua Fort.

But ſome have another way, *viz.* When the *Bottle* is put in, then they lay round about the Neck good prepared *Clay*, and over the *Clay* they lay Paper, ſo that the *Helm* may not quite ſtand on the *Clay*, and this is done for this Reaſon, that the *Helm*, (after the diſtilling) may looſen it ſelf clean; and then they do ſet upon it the *Helm*, and lute it over with good *Clay*; and laſtly, apply the thin ſtuff upon a little *Cloth*, that no ſpirits at all may go out.

3. *Another way.*

You ought alſo to prepare the *By-Oven*, and likewiſe the *Jug* or *Bottle* with the *Helm* ſet in Order, that the mouth of the *Helmet* may go out a pretty diſtance over the *Oven*, then lay before it the *Receiver*, that the mouth of the *Helm* may well reach into it, that you may ſee how the water doth go, and the drops fall.

4. *Water in the Receiver.*

And

And that you may alſo know how much the *Vitriol* hath loſt of its weight; firſt, in the *Calcining*, you muſt put ſweet or flowing Water in the *Receiver*; elſe the Water will be too ſtrong, and very little water will remain, alſo lute all very well over the Joynings on the *Receiver* and *Helm*, thus, Take ſome of the prepar'd *Clay*, and lay it about the *Joynings*, then put in the *Clay* (through the joynings, in the *Receiver*) with a little ſmooth ſprig of a Broom) which will do this Service, that the firſt and groſs ſpirits (as you ſhall hear hereafter) may come through it; then upon the *Clay* lay a little *Cloth*, as aboveſaid, that the Joynings may every where be luted-over, and let it be dry: Thus alſo you may ſet into the *Oven*, the *Jugs* with the *ſtuff* on both ſides the *Athanor*, and with one fire burn and make perfect two or three works, and mannage every one according to its neceſſity without hindrance to the other, of giving or taking heat, as hereafter ſomwhat more may follow.

CHAP. XXIV.

How Aqua fortis *is to be* diſtilled *in an* Iron Jug *or* Pot.

1. BUT if you will put the ſtuff in an *Iron Jug*, which is caſt or hammered, and diſtill *Aqua fort.* in it, then put the *Jug* with its ſhort feet, upon an *Iron Grate* or *Roaſter*, that it may ſtand firm and faſt, but if the *Jug* hath no legs, then it muſt ſtand upon a three-legg'd *Iron*, proportioned to the *Jug*, and before you do put the *Helm* on it, firſt place upon the *Jugs* neck an old broken neck of a glaſs Bottle, and then

Of Jugs caſt or hammer-ed.

then put the *Helm* upon it, so the *Helm* will remain whole in taking off: But if you have not a *glazed Neck* (as is said) then *lute* the *Jug*'s *neck* round about with the prepared *Clay*, and lay over the *Clay* a Paper (as abovesaid) upon the *Helm*, and over-lute it the best you can, then the *Helm* will go from it the better. CHAP. XXIV.

Section. 2. *To place the same.*

When you have set into the *Athanor* the stuff with the *Jug*, and all the over-luting is well dryed, then put into the *Tower* of the *Athanor*, live *Coals* upon the same, with other *dead Coals*; so that the *Tower* may be full to the top; then cover the *Tower* with a thick *Cover* made of *Potters-Earth*, but you must lay *Ashes* upon the *Tower* half an hand thick, and so fit the *Cover*, that no *vapor* at all may goe out, and let the *wind-hole* below, on the *Athanor*, be open which is mark'd in the beforesaid *Sculpture*, with *Figure* 3: and shut the *wind-holes* of the *By-ovens*, and the *Mouth-hole* of the *Athanor* very close, mark'd with the *figure* 2. and draw it not open too soon with the Instruments noted at *Figure* 6.

3. *Of governing the Athanor.*

But, when the *Aqua fort.* doth begin to go, then open but one *wind-hole*, and, if it will not go well, then draw the Instruments a little nearer to the *Tower*, so the heat will go through the same space, under the *Jug* or *Bottle* which is set in, and in which the Ingredients are, and presently, the water will begin to run better.

4. *Of disposing the gross spirits.*

Now, if it thus proceeds, then a *Vapour* will come into the *Receiver* (these are the gross spirits) then let them go out through the little *Pin* of Wood near the *Lymbeck* of the *Helm*, then stick it in again, and lute it over the best way you can, that no more spirits may go out, and when the drops fall into the *Receiver* to five or six, so the water will go in the beginning from the *calcination stuff*, with which *governing*, *shutting* and *opening* of the Instruments, you may alwayes keep the *Oven* in order that the water may go well. But when you put the *stuff*

Chap. XXIV. *raw*, uncalcined in; then you muſt do it very gently in the beginning, that the *drops* may fall in, to 15 and 16, &c. But 'tis a tedious and long while in diſtilling, and there can no more water be had than of the *calcined ſtuff*, therefore it is always firſt to be *calcined*, and when from the *calcin'd ſtuff*, the *drops* are fallen one or two hours to 5, 6 and 7 *drops*, then you may draw a little more with the *Inſtruments* which are between the *Athanor* and *By-Ovens*, and then the heat will be ſtronger, and the *Drops* will fall faſter.

Section. 5. *When it doth go too hot.* Now, when the *Drops* come but to two and three, it goeth too hot: then with the mentioned *Inſtrument* ſhut the under *wind-hole* again, very cloſe: whereby they will go ſlower again, for in too hot going there is danger, that the *ſtuff* ſhould aſcend, and daſh all in pieces (whereby cometh Dammage) and although the *calcined ſtuff* doth not eaſily aſcend, yet it may ſo happen in going on (eſpecially if the *Jugg* be filled too much with the *ſtuff*.)

6. *How the drops muſt be counted.* And know that You muſt number the drops according as one beateth with a hammer or fiſt, or keepeth a *tact* or time as in Muſick: *viz*. as many common *ſtroaks* as can be done betwxt the drops, may be 4, or 5, or more, they are to be called *ſtroaks*, therefore govern the fire alſo in an equal heat, untill the water come almoſt over, and the *Helm* and *Receiver* become *Cherry-brown*.

7. *To force the Spirits.* Then you muſt ſtrengthen the fire with opening of the Inſtruments while the Spirits go through the *Limbeck* or *Noſel* of the *Helm* and *Receiver* of the water, by which the *Helm* and *Receiver* (as is ſaid) becomes brown. Then haſten not with the forcing of the fire, till at laſt, when the *ſpirit* is gone an hour to ſix or more, according to the quantity of the *ſtuff*, and the Receiver be no more ſo brown, then open the Wind-holes markd with the

the *figure* 8. and lay in the ſame holes under the *Jug* or *Bottle*) ſmall ſplit Wood, and force it with the fierceneſs of the flame, that the reſt of the ſpirits may come over, and that all ſtrength may come into the water, ſo as the *Helm* and *Receiver* become white again, and that alſo the *Jug* or *Bottle* which is put in, may glow near an hour well with the *Caput mort.* ſo that which remaineth behind in the *Jug* or *glaſs*, may have no more ſharpneſs in it but become dry and of a *reddiſh Brown*. CHAP. XXV.

When the *Aqua fort.* is thus diſtilled, then let the *Athanor* be opened and cool well, and lay over (above the neck of the *Helmet*, where it is luted) a wet cloth, alſo near the *Lymbeck* of the *Helm* over the *Receiver*, mollifying the overluted hard *Clay* well, that it may go off, that you may not break the *Limbeck* of the *Helm*, which you may uſe afterwards (the *Receiver* being firſt to be taken away) then put the made *Aqua fort.* into a *Glaſs*, and ſtopt it with *wax*: thus you have good *Aqua fort.* Section. 8. *The Glaſs Limbick and Receivers to be taken off.*

You may alſo be inſtructed, That when you are diſtilling of *Aqua fort.* and that the *Coals* in the *Athanor* are almoſt gone out (which happens hardly in 10 or 11 hours) then lift up the *Cover* from the *Athanor*, make it full again with *Coals* and cover it, elſe the Fire will go out, and all will be cold, as Oportunity it ſelf will teach thee and make thee to remember.

CHAP. XXV.

How to diſtil Aqua fort. *in* 4, *or* 5 *Hours.*

IF one in haſte would diſtil *Aqua fort.* and cannot have ſuch an *Athanor*, then muſt be made a little *Oven* on a wall three quarters of an *Ell* ſquare, and two *Ells* high, and put in it an *Iron-Grate*. ſo that below there may remain a *Wind-hole*, 1.

CHAP. XXV. *hole*, and on this little *Oven* make another little *Oven*, in which may be put the *Jug* with the *stuff*, cause an *Hole* to go out of the Oven, which is set first into the *By-Oven*, lay also a *Grate* in it, as you have done in the *Athanor*, and you may in stead of the earthen Instrument before noted with *Figure* 1. use a smooth *Pan-tile*, and it will do the same thing: or, if you will not spend so much time about an *Oven*, then make but one square *Oven*, which hath a *grate* below, and under it a *winde-hole*, in which you may set the *Jug* or *Bottle* with the *stuff*, take then of the above-mentioned *stuff* four pound of *Nitre*, and three pound and an half of *calcined Vitriol*; Grind both very small, and among it put six pound of *Calx viva*, and let all be well mingled together (but put not so much water in the *Receiver*, as above is taught.)

Section. 2. Now therefore, when all things are well *luted* over, and become dry, then make a fire under it, and let the water go strong over it, so that at all times the water and spirit may come over together, and because the *stuff* is mingled with *Calx viva*, therefore you need not take care for running over, then strengthen the fire mmediately untill the water and spirits are come over.

3. And lastly, the stuff in the *Jug* will glow so well through this Labour, that you may distil in 5 or 6 hours an *Aqua fort.* to which else you must have 24 hours, but you will have but little water, yet 'twill be very good to use for *Separation*.

CHAP.

CHAP. XXVI.

Another good way to diftil Aqua fort.

SO ufe uncalcin'd *Vitriol* for *Aqua fort.* it muft be dryed in the *Sun* till it be *white*,then take thereof four pound,and two pound of *Salt-Petre*, beat it fmall, mingle it together, and fet it in the *Oven* (as is done with the firft *ftuff*) put no fweet or clear water into the *Receiver* : this alfo yields good *Aqua fort.* only you muft (as abovefaid) do very gently in going on, that the *ftuff* may not run over: Section. 1. *To ufe uncalcin'd Vitriol.*

Take to fuch *Aqua fort.* good *Hungarian* or *Goflarifh Vitriol*, or which is boyled out of a flint, and of a fine and high colour, and not of fuch *Vitriol* of which *Alum* is made, for the pale *Alumifh Vitriols* do not yield good ftrong *Aqua fort.* Some take alfo one part of *Copper* water,and burn *Alum* among their Additions, which is left to every ones freedom. This only is needful to be mentioned, That if one take much *Vitriol* among the *ftuff*, fuch *Aqua fort.* which cometh out of it, doth very well work in feparating, and gives much brown fpirit, nor do they improve in the feparation,as other *Aqua fort.* for they hold not faft on in feparation. 2. *Hungarian, Goflaran Vitriol, or fuch as is boyld out of flints.*

Likewife fome take to their *Aqua fort.* four pound of *Nitre* and as much *Vitriol*, which of the two is the beft, you may (like my felf and others) learn by Experience. 3. *Another way.*

CHAP. XXVII.

CHAP. XXVII.

How to make an Excellent ſtrong Aqua fort.

Section. I. *The Ingredients.*

YOU muſt, for the making of ſtrong *Aqua fort.* Take three pound of *calcined Vitriol,* 3 pound of *Nitre,* one pound of burnt *Bruxiſh Alum,* out of *Belgia,* and two pound of burnt flints; burn theſe to a *water,* the firſt *water* let go, untill the *Helm* begins to be colored, caſt it away, lay the *Recipient* again before it, and lute it all over vvell again, and let the other vvaters go over (as I have taught above) at laſt, force all the ſpirits over vvith a ſtrong fire: this *water* keep in a good Veſſel, and put to it, in an overluted *glaſs Bottle,* 6 *Loths* of *Nitre,* 4 *Loths* of *Vitriol,* and tvvo *Loths* of burnt *flints,* and one *Loth* of *Verdigreaſe,* and one *Loth* of *roaſted Antimony,* and one *Loth* of filed *Iron,* and half a pound of *white Lead,* and let all theſe be beaten to ſmall pouder, and put upon it, of the Water now diſtill'd, a little and a little at a time (for it uſeth to make a Noiſe until 'tis all put in) then cover it very vvell, let it ſtand ſome dayes in a Celler, and ſtir it every day tvvice, then ſet it in and diſtill it as an *Aqua fort.* only that the *Helm* may ſoon come upon it, and let it go as long as 'tvvill go, for it vvill begin of its ovvn accord to go; then give it very gentle fire, and dravv it moſt gently over ſo long till all the water is brought over, then augment the fire, the fiercer the better, until the ſpirits vvith great heat are all come over, (which hardly is done in two dayes and two nights) like as you have done before with the *Aqua fort.* then let the *Oven* be cool, and take of the *Aqua fort.* and cleanſe it

it from the *feces*;and preserve it in a sound Vessel which holdeth well, for 'tis an exceeding strong water, and use it. CHAP. XXVIII.

Some will say of this Water, That by it somewhat more of *Gold*, in the Separation, is to be obtain'd, than by common *Aqua fort*. Experience will manifest it; for my part, I believe it not: and for such Hopes without ground, I was neither willing to expect, nor to try in distilling. Section. 2. *More Gold by this way.*

You may also be instructed, That to this Water you had need of a *great Recipient*, wherein the spirits may have room; and, if you will take off the *Recipient*, and lay it before again, then you may lute over the *Joynings* with *lute* made of two parts *Clay*, and one part of *Quick lime*, and moistned with *Rape Oyl*, and lute it: such a *Clay* the spirits do not touch, but the other which is used, by some, to lute with, they touch, and thereby are made alwayes leaky, and never holds well. 3. *A Lute upon which the Spirits do not work.* Linseed-Oyl

CHAP. XXVIII.

How to distil an Aqua fortis, *called* Aqua Regis, *which dissolveth* Gold, Copper, Iron, Lead *and* Tin; *also* Mercury sublimate *and* Arsnick.

PROVIDE good *Aqua fort.* which is distilled only from *Salt-Petre* and *Vitriol*, and purified with *Silver* from its *dregs* and *fæces*, and in which one may dissolve *Silver* as necessity requires, put it into a sound well luted *glass Bottle* or *Culb*, and add 8 *Loths* of *melted Salt*, which *Salt* in flowing must not run over, but as soon as it floweth must be put out, that it may remain in its strength and 1. *Ingredients.*

virtue,

CHAP. XXVIII. virtue, and only come off from the flegm or superfluous moisture ; now,as soon as the Salt comes in it, then lay the luted *glass Bottle* with the *Aqua fort.* and *Salt* side-wayes in the *Oven* in which one useth to distil *Aqua fort.* but thus, That you may lay to the *Bottle* the *Recipient* also, and lute it well, then it will soon begin to go off, by its own Virtue, then draw the *flegm* over with a small fire, and strengthening the fire more and more, at last force the spirits to come over, as is usual in distilling the *Aqua fort.* and you must drive the spirits much longer because of the *Salt.*

Section. 2. *To draw over by degrees.*

Then you may finde that by this way of distilling by degrees, there will be a fine *yellow* and stronger *water*, because the spirits will not ascend too high, (as over the *Alembeck:)* But it requires good diligence and observation to prevent the water from running over: This *Aqua Regis* when 'tis thus burnt, may presently be used, and hath no need to be purified from its *feces.*

But how to *distil* it by degrees you may see in the following *Sculpture*, thus

Deciphered,

1. *The* Tower *of the* Athanor, *in which the Coals are to be put.*
2. *The* Oven *in which the* Bottle *is to be plac'd.*
3. *How the* Bottle *is to ly in the* Oven.
4. *The* Glassy Helmet, *made for it.*
5. *The* Recipient *or* Receiver.
6. *The Pot full of* Materials *prepared.*
7. *The* empty *Pot.*
8. *The Person that tends the* Athanor *and By-Ovens.*

Sculpture

Sculpture XXII.



CHAP. XXIX.

To distil Aqua fort. *in* Retorts *with other* Advantages.

DISTILLING *Aqua fort.* in *Retorts* is no old *Invention*, and no long Labour, but a short way; if *Retorts* may be had which are made of one piece, and will hold *Aqua fort.* and *Oyl*; then lute such over with good and sound *Clay*, let it be well dry, put in it the *Ingredients* or *stuff*, which shall be *calcin'd* and mingled with *Calx viva*, and lay the *Retort* in an *Oven* made on purpose (whose Description shall follow hereafter) and fill a *Receiver* with water before it, then make a fire in the *Oven* (and speedi- Section 1.

CHAP. XXIX. Section. 2. *Calx viva hinders the running over*

ly increase it) then the *stuff*, because it is mingled with *Calx viva*, will not run so soon over, because the *spirits* and water are to go over together, at last force the *spirits* with *Fire*, so that the *Retort* may glow bright, near two hours, at least: In such a *Retort* you may distill the *Aqua fort.* in 5 or 6 hours, but it will not yield so much water as through the *Alimbeck*, but it will be strong and good for use.

3. *For want of a Receiver.*

If you cannot have a great *Receiver* (as it often happens) to the distilling of the *Aqua fort.* then take a great *Waldenburgish Jug*, or one made of the like *Clay*, (that it may hold *Aqua fort.* lay that before as a *Receiver*, and make the Process, as now is signified, such an one I esteem better to the distilling of *Aqua fort.* in *Retorts*, than in a *glazed Receiver.*

But when you will use it (in stead of the *glazed Receivers* to lay before the *Jug* and *Helm*) then you must have a neck of a *glass Bottle*: Lute it well over in the *Jug*, so that the Neck may reach out of the *Jug* near a Span, in the same Neck lay the *nossel* of the *Helm*, and lute it also well over, so you may see in the neck of the glass *Bottle*, how the drops do fall, and govern the fire accordingly.

4. *Earthen Receivers with Glass.*

Some who distil *Aqua fort.* do make (on purpose for the *Receiver*) great *Jugs* with great Bellies, of good and solid *Clay*, so that near the *Jug's* neck, are to be cut in it square holes, then they fit to it square Glasses of good *Venetian Glass*, and then they lute over the *Jugg* with a thin *Clay* made of *Varnish* and *Bole Armoniack*, and cause it to be dryed well, and when they will lay the *Jug* before, then they place the *Glasses* to the *Jug* and *Nossel* of the *Helm*, so that they may see the *drops* fall well, and that they may govern the *fire* as it should be.

5. *To fit the glass spouts to the Helm.*

Also it often comes to pass, that the *Helms* have not alwayes

always right *ſpouts*, they are either too high or too low: Now, theſe you may make your ſelf, as followeth, *viz.* ſlake a Coal-fire upon a *Teſt*, hold the *ſpout* ſo as that it may be only warm, then nearer and nearer; at laſt, lay it on the glowing Coals, and the *noſel* will glow, then bow it in the fire, as you wouldſt have it, but you muſt not take it ſo quickly out of the fire again, leſt it break in pieces, according to this way others are to be bent and fitted like *Pellicans*.

CHAP. XXIX.

Section. 6. *To ſet By-Ovens to an Athanor.*

I have taught before, how the *Ovens* are to be made and prepared in which *Aqua fort.* is to be diſtilled: if it now ſhould happen, that one would at once reſolve to diſtil more than two at a time: then for ſuch the *Athanor* muſt be made ſomewhat greater and larger than for others, but not much, yet may ſerve three or four By-Ovens, which are to be governed with one fire, only the *Inſtruments* which in other *Athanors* are drawn on the ſides, in this muſt be drawn upwards, and hang them on the wall by nails, as the following *Sculpture* doth ſhew.

7. *Another long Oven.*

Beſides this, one may make another *Oven* to diſtill Quantities, in which four or more Jugs may be ſet in length one after another: ſo that the Oven ſtandeth free, and you may alwayes come to lay one Receiver on one ſide, and alſo another on the other ſide; for this Reaſon, not only that it may not hinder one the other, but alſo that on the backſide under every *Jug* may be laid wood, and that the ſpirits may be forced ſtrongly.

Beſides, ſuch an *Oven* muſt have on the loweſt part but one *hole*, in which the fire upon a *grate* is to be ſtored with wood, and under the *grate* one *wind-hole* more, and the ſame muſt not be opened, till the water is almoſt over, that one may ſtrengthen the heat; likewiſe on the upper part, as on the head muſt be placed

CHAP. XXIX. Section. 8. *wind-hole*, that the fire may have its draught in the length.

If then you would diſtill *Aqua fort.* in ſuch an *Oven*, then firſt *calcine*, and prepare the *ſtuff* afterwards; put it into the *Jugs*, and the firſt *Jugg* which ſtands next the fire mingle with *Calx*, then there will not be ſo much danger, that the *ſtuff* will run over: After this, when the water is almoſt over, then open the *wind-holes*, which are alwaies to be behind by the *Jugs*, and force the *ſpirits* over, according to every *ſtuffs* neceſſity, by this you will have alſo good *Aqua fort.* and maiſt diſtil much of it at once, but how the *Oven* is to be formed you may ſee at the *figure* 7. in the next *Sculpture*.

9. *Strong and weak* Aqua fort.

But to return to the *Aqua fort.* I find it neceſſary to mention, That ſome conceive, if they have too ſtrong *Aqua fort*, they will go as far in ſeparating one *Mark*, as of two *Marks* with weak *Aqua fort.* which cannot be: the Reaſon is, that though the ſtrong *Aqua fortis* do touch ſtrongly, yet it cannot take more *Silver* to it ſelf, than the *Aqua fort.* hath wetneſs: I ſay then, ☞ That an *Aqua fort.* which is of a middle ſtrength, and made of good *ſtuff* doth more in ſeparating according to its worth, than a very ſtrong water, for the weak water endures longer in the operation, on the contrary the very ſtrong water conſumeth away ſuddenly, and leaveth off the ſooner. The following *Sculpture*

Deciphered.

1. *The* Tower *of the* Athanor.
2. *The two ſides or* By-ovens *in which the* Jugs *are to be ſet, with the Stuff.* 2.2.
3. *The Glaſs Receivers.* 3. 3.
4. *The earthen* Jug *or* Receiver.
5. *The Oven for the* Retorts.
6. *The little* Receivers *to be added to the great* Receiver,

ver, *that there may be room for drawing the* Spirits.

7. *The Long Oven.*
8. *The* By-Ovens, *by which the* ſpirits *are to be forc'd into the* Aqua fort.

Sculpture XXIII.



CHAP. XXX.

CHAP. XXX.

How Aqua fort. *is to be separated and cleansed from its* Feces.

Section. 1. *The way.* WHEN the *Aqua fort.* is distilled,(according to the *Instruction* given) then it is not to be used *raw*, as it comes from distilling, but it must be first cleansed and *precipitated* from its *feces*; that it may be pure and clear, and this is done thus, If the distilled *Aqua fort.* be two pounds,then put near 2 *loths* of it into a little glass *Vial*, and dissolve in it *half a dram* of *fine silver*,and while the *Solution* is yet warm, put in, the other new burnt *Aqua fort.* so it will become white and thick as milk, stir it once or twice a day, every day, then let it stand one day, and one night till the *feces* do settle in the bottom like a *Calx*, when it is become wholy clean and clear,then put it off, and you have *purified* or *precipitated* the *Aqua fort.* for the separation prepared; ☞ only take notice that the *Aqua fort.* distill'd in an *Iron Jug.* doth not give so much *feces*, neither is it so unclean as that which is burnt in a *glass Bottle*, because the *Iron-Jug* is a Metal of it self, upon which the *Aqua fort.* doth partly purify it self, and it likewise gives to the *Gold* a higher and finer colour than the other: Keep the *feces* clean together, pour it off, enter them into the *Lead*, and let it go off upon a *Copel*, so you will find the most part of the *Silver* in it, which you have used to the *precipitation*.

2. *To bring the feces to profit.* Some use this Method, *viz*. They do *precipitate* the new distilled *Aqua fort.* with *Hungarian* or *Bohemish* Pence, or such like Money, which to the separating is all

all one, only the *Aqua fort.* remains not ſo clear, fine and white, but becauſe there is *Copper* in it, therefore the *Aqua fort.* becomes a little *green*: for this Reaſon, this *Aqua fort.* ſettled with *Coppery* Money cannot be uſed to the *Gold-Proof*, for the *Copper* which is in the water ſticks rather to the *Gold Calx* than to the *Silver*, and then 'tis not eaſily waſh'd off ſo clean: which is prejudicial to the *Proof*: but, if after the firſt ſetling, the *Aqua fort.* be unclean, then you may ſettle it once more, and then uſe it to Separate or prove *Gold*, according to your pleaſure.

CHAP. XXXI.

How weak Aqua fort *is to be made* ſtronger.

IF it ſhould be neglected in the diſtilling of the *Aqua fort.* as eaſily may be done, when the *Joynings* are not well luted over, ſo that the water will become too weak, and in the ſeparating will not touch the *Silver*: ſuch weak waters may be made ſtronger by two wayes: *Firſt*, ſet in again a new *ſtuff* of *Nitre*, and *calcined Vitriol*, and put the weak *Aqua fort.* in the *Receiver* before it, and *diſtil* the *ſtuff*: after this make the *ſpirits* to go well over, ſo the *Aqua fort.* will become ſtronger, that it may be uſed well and ſafely in ſeparations. Section 1. *To Prepare iron.*

2. *Second proceeding.* The other way is ſhorter: thus, Set the weak *Aqua fort.* in a glaſs *Bottle* or *Culb*, which muſt be luted over upon a Coal-fire, heat it till it begin to boil, then the waterineſs of it will boil off, which you may often prove while it is boyling, whether the water do become ſtrong enough. Or, ſet the weak *Aqua fort.* in a *Bottle*, which is luted

over

CHAP. XXXII. over in the *Athanor*, or in another *Oven*, (in which one useth to burn *Aqua fort.*) and put an *Helm* upon it, and draw off from it the *Flegm* or superfluous waterinefs, until the *Helm* begins to be *brown*, so the weak *Aqua fort.* will become stronger and is fit for use.

Section. 3. *To draw off the flegm.* The *Flegm* which is dravvn off you may retain, for if you do distil another *Aqua fort.* then you may use it in the *Receiver* again, for this *flegm* is much better than common vvater.

CHAP. XXXII.

How Gold *and* Silver *in the* Aqua fort. *is to be* separated.

1. *The Preparation.* TO separate *Gold* from *Goldish Silver* in the *Aqua fort.* Knovv that the *Silver* must first be burnt clean upon a *Test*, then cast it into an *Ingot*, and beat it thin upon an *Anvil*, and cut it into little *lamins* or thin pieces, bovv them that they become hollovv, glovv them in a *Crucible* that the *Aqua fort.* may touch them the better, such glovved *Lamins* vvhen they are cold, put them into a luted neck separating *Glass*, and put not above five or six of those *Mark-Goldish-silver Lamins* in at once; (because of the Danger in breaking,) and if you have much *Silver* (for they take much room vvith the *Bottles*) then put upon it so much of the purify'd and setled *Aqua fort.* that it go over the *Silver* a good large Finger, and as soon as it begins to vvork of it self, put the *separating Glass* vvith the *Silver* upon a *warm Sand* in a great *earthen Test* of good *stuff* upon an *Athanor*, that the *Sand*, may alvvays remain hot, and vvhen the

first

first *Aqua fort.* hath work enough, that it will touch no more, then put away the *Silvery Water* into another luted *Bottle*, but not too hot, that the *Bottle* may not break, and put upon it other good *Aqua fort.* which hath not been used, set it in warm Sand,and let it work the second time, but a little stronger than at first, until it will work no more: Then put it clean off to the *Silvery Aqua fort.* and put upon it the third time *Aqua fort.* and set it upon the *hot Sand*, and let it work strongly, and with great *Bubbles*, until all the *Silver* be dissolved from the *Gold*, which will come out very clean through the three waters now mentioned: But, if one had more to separate, one might use the last water upon other *Silver*, and put it upon it the first time, for it will touch and work so that somewhat of the *Aqua fort.*may be spared. CHAP. XXXII

Section. 2. *The Second Proceeding.*

Know also,that upon one *Mark* of beaten Silver, there will remain one Mark and a half of good *Aqua fort.* and upon a Mark of *thin graind Silver*, (because the *Grains* remain somewhat thicker, and not so light as in beating) two *Marks*; now when the *Aqua fort.* hath separated and attracted all the *Silver* from the *Gold*, then put the *Silvery Aqua fort.* together in a *Bottle*, as abovesaid,and upon the *Gold* or *Gold Calx* (which remains in the *Bottle*) clean, boyling *hot water*, so that it go well over the *Gold*, and put it over again, let it boyl well with the *Gold calx*, then put it off in a particular *Vessel*,clean and pure, that nothing come off from the *Gold*, and put upon it another clean *hot water*, let it boyl with it, do this until the water goes off from the *Gold* very clean and clear, and hath no *sharpness* at all in it, and that it take to it self the remaining *Silver* which the *Aqua fort.* hath left behind with the *Gold* in the moistness, till it cometh clean, this is called *dulcifying*,but that you may be sure that you have the *Silver* sweetned clean, prove it

3. *To dulcify the Gold, Calx.*

CHAP. XXXII. thus, let fall a drop in a *Coppery clean dish*, and if it do not ſtain it, then 'tis *dulcifyed* clean, ſuch ſweet waters are all to be put together, becauſe of the *Silver* in it, and uſe it for *precipitation*, (of which you ſhall have an inſtruction hereafter) When the *Gold calx* after this manner is taken clean off, then hold in your hand the *Bottle*, and put the *Gold* or *Gold calx* very gently out into an half *Glaſs Bottle*, with the laſt clean water together; then put it again into the *Bottle* or Culb, and hold your hand before it again, and turn the *Culb* ſo that all the remainder of the *Gold* (together with the water) may flow againſt the *hand*, then put it finely and gently to the other *Gold* in the *half Bottle*.

Section. 4. *To glow out the Gold Calx.*

When all the *Gold calx* is ſettled in the half *Glaſs Bottle*, then drain the water off cleanly, and put alſo the *Gold calx* (being moiſt) into a clean Crucible, and ſet it on the fire, and let the water ſoftly *evaporate*, and boyl in; then ſet the *Crucible* warmer, and at the laſt very hot, that the *Gold calx* may glow clean out, then the Gold will receive a fine *colour*, let it be cold, and weigh it, then in the caſting all together nothing will go from it.

Now if you will caſt together the *glowed Gold calx* then mingle it with a little *Borax*, and put it in a new clean Crucible, (but rub it at firſt very clean with chalk) and ſet it in the Fire, and when the Crucible gloweth, blow to it that the *Gold* may come to flow, of this you may uſe a little in the *Fluſs*, and when you will caſt it, then lay

5. *To caſt the Gold.*

a clean little Paper upon it, which is Luted with *Venetian Soap* and *Wax*, and while the Paper yet burns upon the *Gold*, caſt it out under the Flames, ſo it will receive no *ſcum*, but will caſts it ſelf alſo clean, but if you will caſt an *Ingot*, then make the *Ingot* warm, and *Lute* it with *Wax*, and then quench the caſt *Ingot* with *Urine*, and ſo the *Gold* will become *fine* and *deft*.

But

But if one have much to ſeparate, if it be *Golden grain'd* or *Gilt Silver*, and you would ſeparate it in the water, then it muſt be firſt burnt clean upon a *Teſt*, and the burnt *Silver* muſt be *Grained*, (for it would be a hindrance to the *Separator*, if all *Silver* ſhould be beaten) eſpecially in a great quantity, yet he who hath time and opportunity, will do better to beat the *Silver*, or cauſe it to be beaten, whereby the ſeparation will be done ſooner and with leſs *Aqua fort.* (as above is ſignified) but if you want time and opportunity to beat it, then take the burnt *Goldiſh Silver*, and ſet it in a Crucible in a *Wind Oven*, and grain it with a ſplit or round ſtick, or ſtir the water with a ſtick faſt about in the Veſſel, to make the *Silver* caſt it ſelf into *Bubbles*, whereby it will *grain* it ſelf thin and hollow, and when 'tis drayn'd, then dry and glow it, and put it in the *ſeparating Glaſs*, and put *Aqua fort.* upon it, that it may go over it pretty well, and ſet an *Alimbeck* upon it, that it may begin to move of it ſelf, and, when it ceaſeth working, then ſet the ſeparating *glaſs* upon the *Copels* in the ſand upon the *Athanor*, and let the *Alimbeck* or *Helm* ſtand continually upon it, and what Water goeth off from the *Aqua fort.* keep that ſame by it ſelf, for 'tis in the diſtilling of the *Aqua fort.* to be put into the *Receiver*, and is better than common *Aqua fort.* and you muſt ſtill govern the fire in the *Athanor* by ſtrengthning and weakning it as the work requires: and of this *graind Silver*, put 9 or 10 *Mark* of it into a bottle at once, for it will not take ſo much room as the beaten, yet if there were a quantity to ſeparate of the *Golden ſilver*, one may prepare more of ſuch *Athanors* than one, that divers of the *Bottles* may be ſet in at once, but you ought to obſerve this, that one muſt put upon the *Graind* more than three times freſh *Aqua fort.* for the thick *Grains* ſake, that the *Gold* may be pure.

CHAP. XXXII. Section 6.

7. *To ſeparate the Silver for granulating.*

8. *Aqua fort. for the granulated Silver.*

And

CHAP. XXXII. Section. 9. *When a glaſs Bottle breaks.*

And if it happens that a *Glaſs Bottle* ſhould break, and the *Silvery Aqua fort.* run into the *ſand,* 'tis not quite loſt, for one may boil moſt part of the *Silver* out of the *Sand* again with warm Water, and that which remains in the *ſand* may be mingled with that which is ſwept off, and paſſes through the *melt Oven,*and be made to profit, but of ſuch danger there is little Fear upon the *Athanor,* eſpecially if you have good *ſeparating Glaſſes,* and alſo are *careful.*

10. *To dulcify the Silver.*

When the *Silver* is ſeparated clean from the *Gold* then ſweeten the *Gold Calx* well out, *dry, glow* and *caſt* it together (as often as hath been mentioned) and know, if you have been diligent in ſeparating and ſweetning it the *Gold* which comes out by the ſeparation, will be 23 *Carats* and one *grain*; but commonly it cometh to 23 *Carats* and 7 or 8 *grains.*

11. *The Content of parted Gold.*

Further, I add as a *Caution,* That you muſt not let the *Aqua fort.* evaporate too dry upon the *Gold* (as many times it happens by Negligence) whereby the *Silver* can not ſet it ſelf on the *Gold Calx* again,which afterwards the other *Aqua fort.* will hardly touch, and therefore ſo ſoon as one part of the laſt *Aqua fort.* be poured from the *Gold,* one ſhould quickly caſt upon it hot flowing water before it be cold, that the *Silver* may not ſettle it ſelf too hard on the *Gold,* and turn to *Criſtals,* and though hot boyling water will diſſolve thoſe *Cryſtals,* yet 'tis better, it may not be, but be ſoon dulcified.

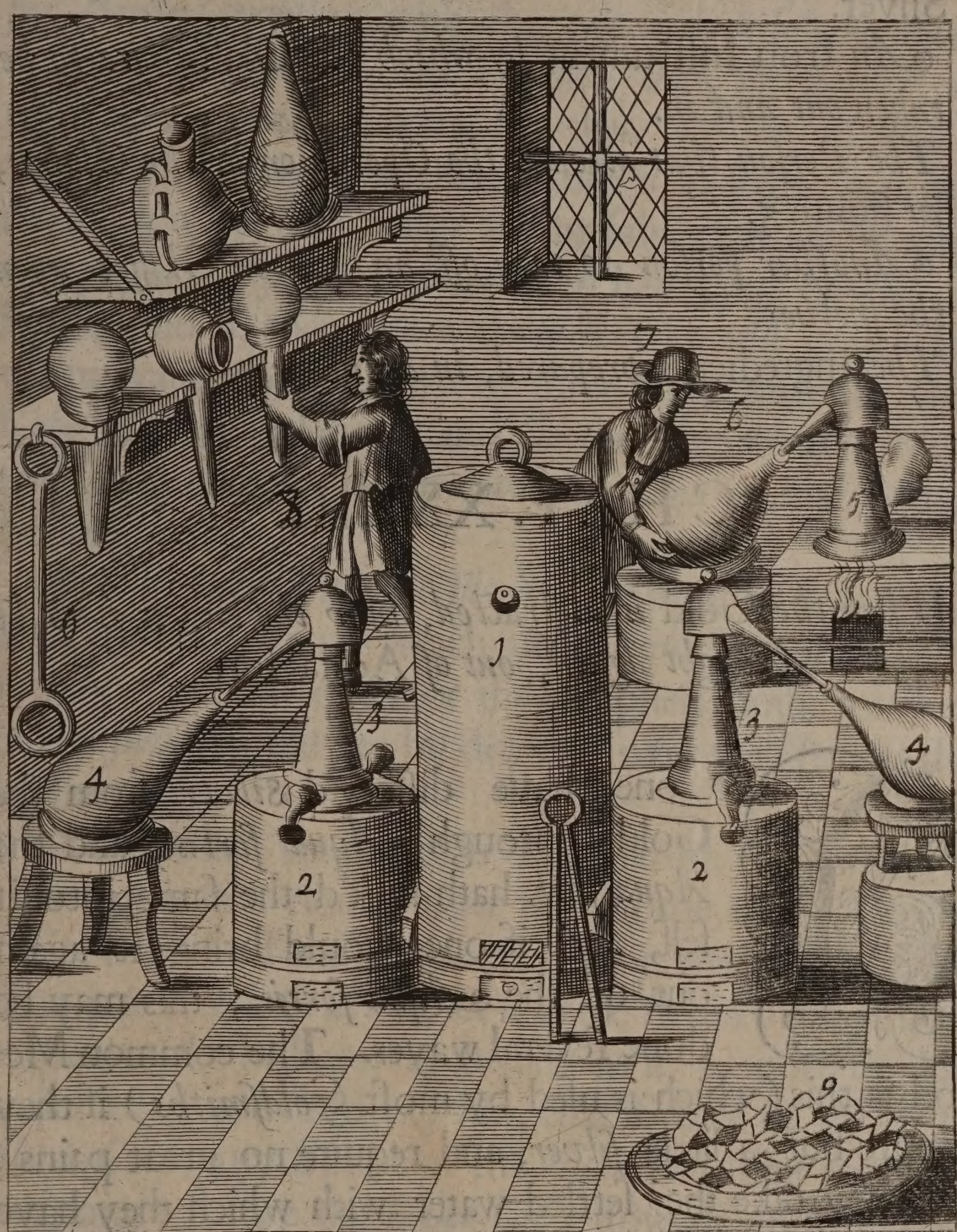
12. *To ſhute into Criſtals.*

13. *When the Aqua fort. remains Silver.*

Likewiſe, if it be neglected ſo that the *Gold* ſhould come too white out of the ſeparation,and were not of a high Content, then it is by the *Cement* (as in next *Sculpture* is ſignified) to be perfectly cleanſed. But that you may underſtand the Labour of the *Separation,* and how the *Ovens* and ſeparating *Glaſſes* uſe to ſtand, you will alſo ſee in the following *Sculpture.*

Sculpture XXIV.

CHAP. XXXII.



Deciphered.

1. *The* Tower *of the* Athanor.
2. *The* Side-Ovens *upon which the* Copels *are placed on Sand.*
3. *The Glaſs Bottle for Separation covered with* Helmets, 3. 3.

CHAP. XXXIII.

4. *The Receivers which are laid to the Helmets.*
5. *How* Aqua fortis *is by them to be drawn from the* Silver.
6. *An* Iron Inſtrument *by which the* Glaſſes *are to be taken out and in.*
7. *The Perſon that attends the Operation of the Glaſſes, in* figure 5.
8. *Another perſon to take off and put on Glaſſes upon the ſhelves.*
9. *The* Ingredients *prepared, in a diſh or pan.*

CHAP. XXXIII.

When the Gold *is abſtracted, how the* Silver *is to be brought again, out of* Aqua fort.

Section. 1.

IF one hath diſſolv'd *Silver* from the Gold, through *Aqua fortis*, and the *Aqua fort.* hath ſuck'd the ſame into it ſelf, and if one would bring it again out of the *Aqua fortis*; this may be done ſeveral wayes. The common Method is this (which is uſed by moſt *Goldſmiths*) if they ſeparate but a little *ſilver*, and require no great pains, then they take the ſettled water with which they have purified the *Gold* (as is ſaid before) and put it in an half Bottle made of *Copper*, to the *ſilvery Aqua fortis*: only obſerve the right meaſure, for if the ſetled water be but little, and on the contrary, if the *ſilvery Aqua fort.* be too much, then it will begin to work too hard in the *Copper Bottle*: to prevent this, put into the *Copper Bottle*, to the ſettled water, and to the inweighed *Aqua fort.* a little more warm common flowing water, and then it will not ſo much hurt the *Copper-bottle*; and the

the *Silver* will quickly and apparently fall down in the *Copper Bottle* : Let it ſtand a while, then put the *Copper Bottle* (together with the water and fallen *Silver*) over the fire, let it boyl a little ; then the *Silver* will the better and cloſer come together. CHAP. XXXIII.

When this is done, then cauſe it to ſettle and pour the clean water off (which will be fair, clear and tranſparent) put the *ſilver Calx* into an half-*Glaſs* bottle, or, if it be much, then into a clean Kettle, and pour clean warm water upon it, two or three times, until the *ſilver Calx* be clean and pure, and ſee that the *Silver* alwayes ſettle well, and preſerve it carefully together, that nothing be loſt.

Section. 2. *Why the Silver Calx is ſweetned.*

The Reaſon why the *ſilver Calx* muſt be dulcified, is Becauſe the ſharpneſs which the *Aqua fort.* hath left in it may come out of it, for the ſharpneſs doth rob ſome of the *ſilver* in the fire by drawing over the *Helm* as ſhall be ſhewn.

Now, when the water is drain'd from the *ſilver Calx* then put it in a clean *Copper* half Bottle, and let the water of it boil off and evaporate, that it may be very dry, then put it in a *Crucible*, ſet it in the fire in a *wind-Oven* or before the bellows, according as it is more or leſs: make it not too ſuddenly hot, that if there be left by the *ſilver Calx*, any Spirits of the *Aqua fort.* that they may evaporate before the *ſilver Calx* floweth, and the waſte of the *ſilver* may become the ſmaller, which waſte is not often ſmall, and comes all from the ſpirits, for if they could be retained in the *ſeparating Glaſs* then little would go off from the *Silver*.

3. *The content of the Precipitated Silver.*

After the melting together of the *Silver* in the *Crucible*, then *grain* it, or caſt it in an *Ingot*, as you pleaſe, this is the old manner of the *Goldſmiths* and common *Separators* to cleanſe the *ſilver* out of the *Aqua fort.* and this *ſilver* which is thus ſettled out of the *Aqua fort.* is

not

CHAP. XXXIII. not *fine silver*: but it worketh on the *Copper* from which it is to be cleansed, and the stronger the water is in cleansing, the more it will touch, and mingle among the *silver Calx*, and it holds commonly a *Mark* of cleansed *silver*, and this thus cast, holds near 15 *Loth* of *fine silver*.

Section. 4. *To bring the blew water to profit.*

The settled *blew water* is to be used again with profit when you distil ☉*Aqua fort.* and have put the prepared stuff into a *Jug* (whereof *Iron ones* are best) then put of this *blew water* two pound upon ten pound of *calcin'd stuff*; as soon as this is done, set the *Helm* upon it, for it will presently go off it self, without any fire, and lay the *Receiver* before, (without any sweet Water) lute it well every where, and let it first go over the *flegm*, then increase the fire till all the *spirits* are driven into the water (as is said, when we spake of *burning* the ☉*Aqua fort.*) then you may put this *blew* ☉*Aqua fort.* into a great *Culb glass*, which is cut off in the *Neck*, and luted over, and evaporate the moist *flegm* with the *fire*; then it will become stronger, and so put it to the stuff in the distilling.

But the *Aqua fort.* which comes of it, when the *blew water* is put upon the calcined stuff hath not so much *feces* in cleansing and seething down, and is not so unclean as other common *Aqua fort.* which is burnt of other *stuff*, because the *blew water* becomes *Metallick* by the *Copper* in the *precipitation*, and hath purified it self in the *Jug* or *Bottle*.

5. *To precipitate Silver in an earthen vessel.*

Know also, That one may in a *glazed* or *earthen Vessel* (if it be good, and will hold *Aqua fort.* and *Oyl*) cleanse the used *silvery Aqua fort.* and the *silver* precipitated in it, namely, one must put such *Aqua fort.* together with the clear water, (as aforesaid) mixed in the *glazed* or *earthen Vessel*, and lay in it red hot pieces of *Copper*, and set the *Vessel* warm, then the *silver* will quickly fall to the *Bottom*, but 'tis better to cleanse it in

in a *Copper Vessel*, which may be done in a *coppery* or earthen vessel, yet in the cleansing of it, put iron *Lamins*, then the *silver* will come clean out of the water, as Experience teaches. CHAP. XXXIV. Section. 6. *Iron Lamins in the Precipitation.*

CHAP. XXXIV.

How Aqua fortis *drawn from* Silver *may be used again.*

THE Second manner of bringing the *Silver* out of *Aqua fort.* and to draw off *Aqua fort.* so that it may be used again for *Separation*, is a singular ART and Dexterity; 'tis thus, Put the *Silverish Aqua fort.* in a good *glass Bottle* which is *luted* over, and wherein *Aqua fort.* may be distilled, set it in one of the *Ovens* which are for distilling, and luted over (but in an *Athanor* is the best, and not so dangerous, as in a common *Oven*) let it be dry, then put the *silverish Aqua fort.* through a long glazed *Tunnel*, warm and not cold, into the *Bottle*, then set a *Helm* upon it, but not so strong *luted* over, lay the *Receiver* before, and lute the *Joynings* over so that you may take the *Helm* off again, (as you will hear hereafter.) And being thus set in, then dress the *Athanor*, and put fire and Coals in it. And by the Instruments (of which we have spoken above:) first give it a gentle fire, and let the *flegm* go over 9 or 10 *heats* or times (as before) and when the water or *flegm* is almost over, then shut all the *Instruments* on the *Athanor*, and take off the *Helm* again, and fill more *silvery water* through the long *Tunnel*, warm into the *Bottle*, (else it may break and do hurt) and put the *Helm* on again, and lay the *Receiver* be- 1.

 fore,

CHAP. XXXIV. fore, it but lute it not too ſtrong (as at the beginning) and let the water go over again gently.

In this manner 'tis to be done the ſecond and third time with the *ſilvery water*; and when you think it be *ſilvery* enough in the *Bottle*, or haſt no more to put in, and the *flegms* are over, then take off the *Helm* again, and caſt into the *Bottle* (to the *Silver* or *Stuff*) a piece of *Tallow* as big as half a *hazel Nut*, then the *Silver* will not aſcend in the *Bottle*, put on the *Helm* again and lay the *Receiver* before it, and lute it all over well, and the beſt thou canſt: then let the fire go on the *ſtuff* again, and make the fire fiercer (as you ſee convenient) At laſt, give it a ſtrong fire, and force the *ſpirits*, near 12 hours, pretty well, yet not too high in the beginning, but by degrees increaſe it, that the ſpirits may go over with great force, and that the *Culb* may glow very bright, let it ſtand in the fire, near two hours, that the *Silver* may almoſt melt in it, then the *ſpirits* will come all into the water, and the *Silver* freed of them, for if they were not clean forced from the *Silver*, but remained by it, they would hurt it in the *caſting* together, and draw it away; which may be ſeen apparently upon the Coals, that there will lye thick leaves upon it: They therefore who are ignorant of this, do many times work with danger, and great loſs of *Silver*.

Section. 2. One may alſo put the *ſilvery Aqua fort.* into the glaſs *Bottle* luted over upon the *Athanor* in deep *Sand*, and draw the *flegm* (as now is mentioned) gently over, by which may be ſeen how it governs it ſelf in the *Bottle*, and how the water decreaſeth, and ſo have more care in putting in more water: finally, the *ſpirits* will be forc'd over, and the *Silver* be glowed out in the *Bottle*, yet the laſt out-glowing is better to do in my mind, as above in the *Athanor*.

3. When the water is thus drawn over, then let all be cold,

cold, and take off the *Aqua fort.* in the *Receiver*, which you may uſe again very well to ſeparate, eſpecially to the *Gold-proof*, and hath no need of further cleanſing: then take out the *Silver* which was left in the Glaſs, and put it into a *Crucible*, and caſt it together. CHAP. XXXV.

Some of the *Gold-Separators* have alſo this manner in drawing over the water, that they do add to the *ſilvery Aqua fort.* in the *ſeparating Bottle*, if it be ſix pounds, then one pound of the *ſtuff*, of the *Aqua fort.* (*viz.* of *Nitre*, and *calcin'd Vitriol*, as above is ſignified) and do not put it into the *Bottle* untill the water be almoſt gone over, and if the *ſpirits* begin to go over, they lute it again very diligently, and keep the Fire (as is neceſſary in burning of the *Aqua fort.*) that the *ſpirits* at laſt may come over too: and yet they do think that the *Aqua fortis* will receive a virtue and ſtrength again from the added *ſtuff*, and is better for uſe in *ſeparations*; then they force the *Silver* with the *Caput Mort.* (which yet is but little) into a Crucible, and caſt it together: Whether now this way be better than the firſt? Experience muſt teach. So then you will have a good and right Inſtruction concerning the *Silver* and *Gold* ſeparation in the vvater; and 'tis a compleat vvay of ſeparating; eſpecially if one be provided vvith all things neceſſary to it.

Section 4. Another way to draw over the Water.

CHAP. XXXV.

How to ſeparate Gold *and* Silver *by Fuſion.*

AS it is an excellent piece of Art to ſepapate *Gold* and *Silver* (in *Aqua fort.*) *viz.* The rich *Gold* containing *Silver*; ſo is alſo the *Separation* by *Fuſion* upon the poor *Golden Silver*, where the *Mark* contains one peny and an half of

5. How to underſtand Separation by Fuſion.

CHAP. XXXV. Section. of *Gold*, to two or three drams, which is an handſome and profitable ſeparation; ſo that I know no better way: but upon the rich *Goldiſh Oar*, that way is not to be uſed.

2. But this ſeparating by *Fuſion* is to be underſtood thus, That, becauſe the *Gold* in the poor Content of *Goldiſh Silver* is largely diſtributed, (through the Addition of *Gold* in the *Fuſion* in a little *Silver*) it may be brought into a narrowneſs; namely, as when the *Goldiſh Silver* is thirty *Mark*, and one *Mark* contains a dram of *Gold*, then the thirty drams of *Gold* (which are in the thirty *Mark* of *Silver*, will bring in two *Marks* of *Silver*, and then ſeparate it in the *Aqua fort.* which is a very great profit, becauſe that one hath not need to *refine* all the thirty *Marks* of Silver, and then to ſeparate them in *Aqua fort.*

3. If you have a *goldiſh Silver*, which is poor of *Gold*, put it in a *Crucible*, let it flow, and grain it in the water, and if it be but wrought *Silver*, and not fine, 'tis nothing: then weigh the *graind Silver*, and prove it upon fine *Silver* and *Gold*, how much it contains, that you may keep this Account, that there remaineth nothing behind on *Gold* or *Silver*, and alſo canſt certainly know, how much the waſte hath been in the *Silver* by the ſeparation.

4. After ſuch proving and weighing, make the *grain* a little wet again, and take to every *Mark* of *Silver*, four *Loth* of yellow *ſmall beaten Sulphur*, put alſo the *grains* wet into a *glazed* Pot, and put the *Sulphur* upon it, mingle it well together, and cover the Pot with a *Cover*, then lute it well over, and make a gentle *fire* round about: ſo that the *ſulphur* may melt on the *grains*.

When this is done, Let the *Pot cool*, and break it in pieces, then you will find the *grains* and the *Sulphur* burnt very black together, beat it aſunder, and take heed that

that nothing of it ſpring away. After this put the *grains* (thus with the *Sulphur* prepared) into a good Crucible, and upon the *Grains* put alſo a *Mark* of wrought *Silver*, and half a *Loth* of *Copper*; but if it be *burnt ſilver*, then take to every *Mark* two *loths* of *Grain'd Copper*, and ſet the Crucible in a *Wind Oven*, which is made *taper-wiſe* with good and ſound Clay under the *Iron grate* before, towards the *wind hole*, that if the Crucible ſhould run over, yet the *ſcoria's* or droſs of all the ſtuff may flow out of the *Oven* into the hole under the *wind-hole*, then there is no need to gather it ſo largely diſperſed; and, that alſo the Grates may be taken out and laid in again: After ſuch Crucibles are ſet in, then cover them with an *Iron*-cover very cloſe, let the *ſtuff* flow well, and when 'tis flowed, uncover the Crucible, and ſtir it well with a glowing *Iron hook* of a finger thickneſs, and caſt the *Silver* firſt down with *grained Lead*, *viz.* that you may ſpread the *grain'd Lead* upon the *ſtuff* in the Crucible, in which the *Gold* will caſt it ſelf down with ſome little *ſilver*, then put alſo upon it ſome of the ſtuff (as is directed hereafter) and ſtir it once with the *Iron hook*, then cover the Crucible again with the *cover*, and let it ſtand thus a while in the *ſtuff*, then uncover it again, and caſt it down with *grain'd Lead* and a little *grain'd Copper*; do this three times, and always uſe afterwards of the mentioned *fluſs*; but take notice, if you have in the *Crucible* 20 *Marks* of *ſilver*, that you may not uſe of the *fluſs* (to three times caſting down) above 10 *loths*, and one and a half of *grain'd Lead*, and 4 *loths* of *Copper*; for if you ſhould uſe more, then the *ſilver Regulus* might be too great. Now when you have *precipitated*, or caſt it down the third time, let the Crucible ſtand with the *ſtuff* a long time in good *fluſs*, then take it out of the fire, and cool it, and beat it aſunder, and of 20 *Marks* of *ſilver* you

Chap. XXXV.

Section. 5. *Precipitation, or caſting down.*

CHAP. XXXV. will find in the bottom, a *Regulus* of near 6 *Marks* weight, or something lesser, in which there will be as much *Gold*, as in 20 *Mark* of *silver*.

Section 6. *When the* Scoria's *contains Gold.*

After the finishing of the first running or casting the *Metal*, then prove if you find the *scoria's* or dross upon the *Silver*, and the *Silver* upon the *Gold*, and that if the *scoria's* doth contain *Gold*, set it again in a new Crucible, and let it flow, and use your casting with the *grain'd Lead* and a little *Copper* (as before) but not so much, unless the *scoria's* were rich in *Gold*, and then one useth much of the *grain'd Lead* and *Copper*, whereby the *silver Regulus* will become the greater, and the *Gold* will come better together; especially observe, that if much *Gold* be in the *silver*, then use at first most of the lower casting, that you may *precipitate* all the *Gold*, and when you have all the *Gold* in the two *Regulus*'s, and do find

7. *When the* Regulus *is poor in* Gold.

that they are still too poor in *Gold*, that is, if you have not in the same a fourth, or at least a fifth part of *Gold*; by which the *Gold* in separating did not remain whole, then set in the *Regulus* again, *grain'd* and *prepared* with *sulphur*(as at the first time)and put the same ashed *grains* in a new Crucible, and spread a little *Copper* upon it, and cover it with *fluss*, and put a cover upon it, and set it, thus covered, again into the fire in the *Wind-oven*, and let it flow well, then *precipitate* it again with *grained Lead*, and use to every one of the castings the *fluss*, (hereafter set down) and stir it well about with an *Iron hook*; now that the *silver Regulus* be not too great, and not so much (as that you need to separate it in the *Aqua fort.* in vain,) you may help it with the lower *stuff* or castings, whether the *Regulus* be great or small, (as above hath been demonstrated) and so deal also with the remaining *scoria's*, when such is yet rich in *Gold*; for by diligent proving one may always perceive whether the *Gold* be all in the *Regulus*, or whether some be yet be-

behind in the *ſcoria's*, that you may regulate your ſelf accordingly. Chap. XXXV.

When then you have done all things in the *Cruciple* by precipitating and ſtirring about, and haſt lifted out the *Crucible*, then caſt the ſtuff out of the *Crucible* into an iron *Morter*, luted with *Tallow* and a thin *Clay*, and made a little warm (which I judge very good) for in ſuch a caſting the *Regulus* comes clean together; and as ſoon as this is caſt out of the *Crucible*, then ſet the *Crucible* quickly in again in the *Wind-Oven* (eſpecially if the *Crucible* be good, and, That you may truſt to it) Put the ſtuff out of the *Morter*, and beat the *Regulus* from the *Scoria's*, and preſently put the *Scoria's* in the *Crucible*, let it flow till it doth flow very eaſily, and *caſt it down again*, and do it as you are inſtructed at the firſt, then put it again into the *Morter*, and cool it; Laſtly, when all the *Gold* is caſt down in the *Silver-Regulus*, then take the *Regulus* and burn it clean upon a *Teſt*, and *grain* it afterwards, either in the *bubling* water (as above mentioned) or caſt it into an *Ingot* and beat it thin, then ſeparate it in *Aqua fort.* as I have taught.

To this *ſeparating* there doth belong good and ſound *Crucibles*, in which you at once may ſet in to ſeparare near 50 *Marks* of *ſilver* or more, beſides, I have ſeen a Gold-*ſeparator* in *Saxony*, in ſuch a *Crucible* hath ſet in, and caſt down near an hundred *Marks* of good burnt *Silver*, thus prepared with *ſulphur*: But, becauſe it cauſeth ſome fear to ſet in ſo much at once, therefore I judge it better, eſpecially, if one cannot truſt to the *Crucibles*, that one in one *Crucible* may ſet in no more than 50 *Marks* (except it were ſo much to ſeparate) and then ſome more *Wind-Ovens* muſt be made, and more *Crucibles* be put in. 8.

But for a true *Inſtruction* of the *Precipitation* (with the before given manuduction) know, That it hath this 9.

Con-

CHAP. XXXV. Condition; *viz.* When there is put (after the former Directions) much *Goldiſh ſilver* with *ſulphur* prepared in a *Crucible*, and the *Gold* is caſt down with the *Lead*, *Copper* and *Fluſs*, then the *Gold* will *precipitate* or caſt it ſelf from above, ſo you may with a little glowing draw out of the *Crucible* ſome *ſcoria's*, but not the half part, then cover the *Crucible* again, and preciptate it again; and at laſt put the *ſtuff* (as I have mentioned before) in an *Iron Morter*, by this way, I ſuppoſe, that the *ſcoria's* of the *Gold* will be clean at once.

Section. 10. *Another Way to precipitate at once.*

I muſt alſo further Inſtruct, That one may uſe upon the poor *Goldiſh Silver* (of which a *Mark* contains but a *Heller* or *Penny-Gold*) this following Method of *Separation* in the *Fuſion*, firſt, that one muſt put into a *Crucible* of the *graind Gold*, with *ſulphur* prepar'd as above is taught) near 50 *Marks*, and let it flow well, then *precipitate* it with *graind Lead*, and a little *Copper* and when the *Precipitation* is right done, and the *ſcoria's* with all the ſtuff caſt together with the *precipitated Silver*, and the *Regulus* and the *Gold* put in another hot *Crucible*, and again out of the ſame, into the firſt, and then to caſt it into an iron *Mould* of an *Oval* form, well waſh'd with *Clay*, and dry'd again, ſo that it may flow in bredth, and the *ſilver Regulus* with the *Gold* may ſettle (yet broad and thin) and then you will find, that in ſuch caſting that all the Gold will give it ſelf in the *ſilver Regulus* at once, and you need not ſet it in the *ſcoria's* again, but it will be clean and free at once: this now is an ingenious Method, though I never uſed it: becauſe the *ſilver Regulus* is ſo often caſt through with the *ſcoria's*, and doth ſpread among the *ſcoria's*, ſo that the *ſilver* may the better catch the *Gold*, and take it to it ſelf.

To ſuch caſting one muſt have a ſingular *iron-Inſtrument* made on purpoſe to open and cloſe again with two handles, the ſame is to be holden with thick *wet Gloves*

on

on the hands, and poured out to avoid the heat thereof; Every one may consider of this, but, I judge it most convenient, the casting of the *Crucible*, as followeth. CHAP. XXXVI.

CHAP. XXXVI.

How the Scoria's *or dross is to be made to Profit.*

THE remaining *silver* which in the *precipitating* comes not into the *silver Regulus*, but remains in the *scoria's*, you may make to profit, and bring it from it; only observe this, If one useth to the *precipitation* much *Copper* and little *Lead*, then the *Scoria's* will become rich in *Copper*, therefore to make such good again, requires much *Lead*: But if you use to it much grain'd *Lead* and little *Copper* (as hath been taught in my former Instructions) then the *Scoria's* will become rich in *Lead* and poor in *Copper*, and the *Gold* will precipitate never the less (after this manner) into a *silvery Regulus*, which in the well making of the *Scoria's* is very profitable, without any great dammage to the *silver*. Section. 1. *The first way.*

Therefore make it thus, If the *Scoria's* be 30 *Mark* which you would make to advantage, Prepare a very *flat Test*, of good wash'd *Ashes* (as I have taught in the first Book of the *silver* work) set it before the *Bellows*, that it be not too strong, let it be warm, and then put upon it 15 pounds of clean *Lead*, blow it gently, and when it begins to drive, then put continually one piece after another of the *Scoria's* into it, so the *Lead* takes the Content of it to it self, and the *Sulphur* is blown off from the *Test*, also the *Scoria's* doth not stick so much in the *Test*, because 'tis poor in *Copper*: But if there

CHAP. XXXVI. be not enough of Lead, then you may add somewhat more, till all the *scoria*'s be suck'd in: then drive it upon the *Test* clean off, so you will find, that not much more than a *dram* is gone off from the *Silver* in the *separation.*

Section. 2. *Another way.*

Also, one may put again all the *Scoria*'s into a *Crucible*, and let it *flow* in a *wind-oven*, and when 'tis *flowed* very well, the *silver* (with filed *Iron*, or *Iron-Scales* and *grain'd Lead*) is to be *precipitated*, stir it well about, and with the filed *Iron* follow it so long, till the *scoria*'s doth touch no more the *iron Hook*, then lift it out of the fire, and let it cool well: In this *precipitation* (with the *Iron*) the *Sulphur* will loose its strength, and lets fall the *Silver*, and thus with this *precipitation* the most part of the *silver* settles it self in the *Crucible*, which with the remaining *scoria*'s is easy to be brought to profit, especially because it is rich in *Lead.*

3. *The Scoria's is malleable.*

Now, because I am just come to the *scoria*'s, I must (in kindness to the *Reader*) mention somewhat of its rare nature; for first, When the *Scoria*'s is cast into an *Ingot*, while 'tis yet hot, it may be hammered and beaten, as one pleaseth, like *Lead.*

4. Then one may cast *figures* and *medals* which will look like *glassy Oar*, and if one cast forms of it, and turn it over, and lay it upon a gentle coal-fire, till they are warm, then ☞ set it over a coal-fire, and the *silver* will glow out of it, as if it grew in the *Myne*, and, 'twill look lovely and fair: and this I signify, that any one may use it at their pleasure, and, like an Artist, know what is to be done therewith.

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CHAP. XXXVII.

How to make a Fluſs *for* Precipitation.

FLUSS is made by taking *Litharge*, *Glaſs-gall*, and *melted Salt*, of each a like quantity, ſmall beaten, and *filed Iron*, and a like quantity of *graind Lead*, this *Fluſs* or *fluible Compoſition* maketh the *ſcoria's* deſt; ſo that the *Gold* will ſettle it ſelf the *eaſier*, and *precipitate* gently, and not ſuddenly; and if you will uſe it, you may do it the more ſafely in the *Precipitating* with the *Graind Lead* and *Copper*, leſt the *ſilver Regulus* be too great. Section. 1. *How to make it.*

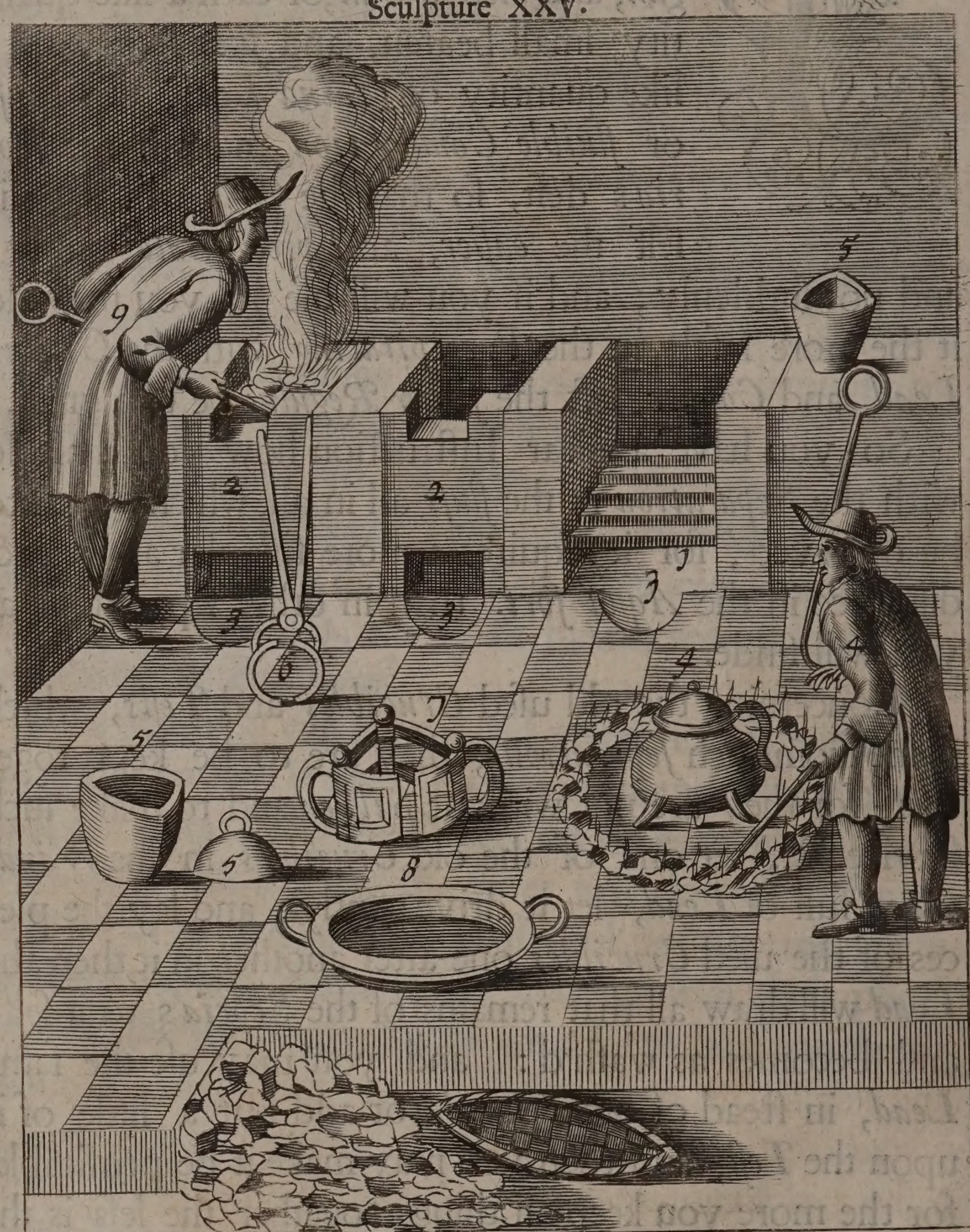
So you have a clear Inſtruction how you ſhall do with the *Separation* in the *fluſs* all in all, which is well to be obſerved, for it requires a more ſingular and exact diligence in the *Aqua fort.* than in other ſeparations, as you will finde. 2. *Separation in the fluſs requires diligence.*

Concerning the old uſed *Crucibles* and *Teſts*, which come from ſuch *ſeparations*, they are to be kept together, for they are not without *Silver*, and to make ſuch ſerviceable, ſet one of the old *Crucibles* in the *Wind-Oven* full of *Lead*, let it drive gently, and lay the pieces of the uſed *Crucibles* one after another in it, then the *Lead* will draw all that remains of the *Scoria's* to it ſelf, and becomes as waſh'd: and you may uſe the ſame *Lead*, in ſtead of other *Lead*, or add but a little of it upon the *Teſt*, and then you may make it be profitable; for the more you keep all things together the leſs is the dammage of the *Silver*: but all is to be *ſwept* together, and waſh'd at once alike, and then melted for your advantage. 3. *The uſe of the Teſt.*

CHAP. XXXVII Section. 4.

And, when in this *Separation* a *Crucible* runs out, (as it oft hapneth) then is this *stuff* and *scoria's* (because 'tis heavy, and remains in the water) like another *Silver* to be search'd and found out. But, that you may see the *Wind-Ovens* (with all the appertaining *Instruments* and Vessels to this Labour severally formed) I have in the following *Sculpture* for this end delineated them.

Sculpture XXV.



Deciphered.

1. *The* inward part *of the Wind-Oven.*
2. *The* outward part *prepared.*

3 *The*

3. *The* holes *next the* wind-holes. Chap. XXXVIII.
4. *The* Pot *in which the* Sulphur *and graind-Mettals are prepared, with a fire under it, and a person attending it.*
5. *A single Crucible, and a cover to it.* 5. 5.
6. *The iron* Tongs, *by which Crucibles are put in, and taken out of the fire.*
7. *The Instrument in which the Crucibles are to be set.*
8. *The iron Vessel into which the stuff or melted matter is to be cast.*
9. *The person attending the Wind-ovens.*

CHAP. XXXVIII.

How to make good and sound Crucibles *for separating the* Fluss.

BECAUSE there must be good and sound *Crucibles* to the *Separation* in the *Fluss*, therefore I will give here a little Instruction how they are to be made: The chief and that of most concernment is good *Clay*, that holdeth well in the fire, of which may be made good Crucibles. Section 1.

When you have such *Clay*, let it be well dryed in the Sun, beat it small, and sift it through an hair *sieve*, put among it the tenth part of small beaten *flint-stones*, which is burnt and wash'd: and half so much small *ground Chalk*, or in stead of that *Glimer* or *Tallow*, or in stead of these *burnt Water-flints* small grownd, mingle all these well together, and moisten it a little; work it well together with your Feet, and after with your Hands: then take smooth pieces of *Pear*-tree, or other strong wood, suitable to the bigness of the Crucibles; 2.

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bles; which may be taken in two parts aſunder, on which may be laid two *iron Rings* or moulds, beat and preſs the *Crucibles* into the ſame, but let the upper part of the *Crucible* be firſt well oyl'd over, that it may the better go out. After the preparation of the *Crucible*, let it be dry in the *Frame*, then the *Crucible* will go out whole, for if the lower part be oyl'd, then the wet *Crucible* might with the upper part, lift up it ſelf out of the *frame*, and hardly remain whole; or, take one part of *Potters clay*, a fourth part of *good Clay*, and a fourth part of the above mentioned *flint-ſtones*: but you muſt obſerve whether the *ſtuff* or *Clay* be too fat or dry, and thoſe Portions which you take unto it, and ſo you will have good *Crucibles* which will not fail.

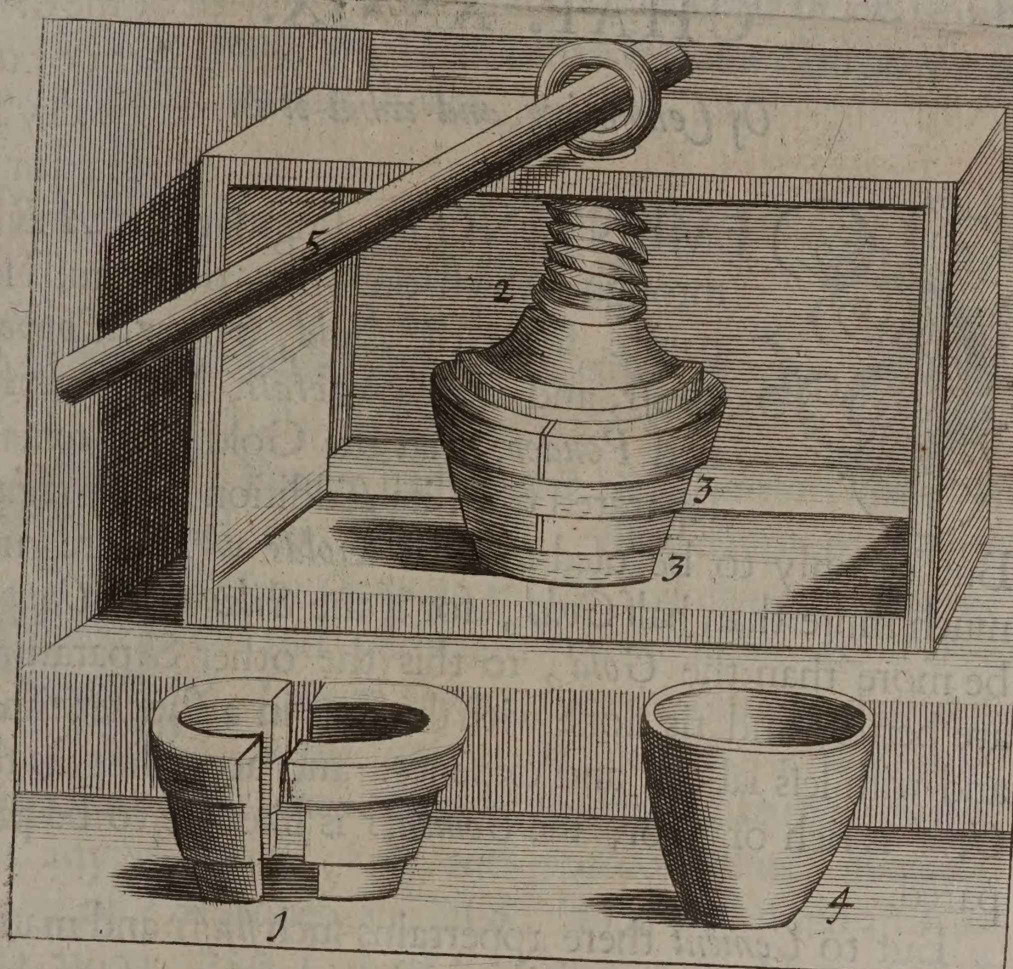
Section. 3.

Some uſe *Crucibles* having three feet, below, upon which ſtand the Ovens, and need not be ſet upon a foot of the *Crucible*; ſuch *Crucibles* I much eſteem of, for the heat may eaſily come without hindrance of the thick bottom, that the *silver* or Mettal in it, may become ſooner hot, than in ſuch *Crucibles* which muſt be ſet upon a thick foot, they ſtand alſo and hold better and longer in the fire than they which are ſet upon particular feet of *Crucibles*, eſpecially when the feet, as well as the Aſhes of the *Crucible* are not ſo very dry, then it draweth the bottom of the *Crucible*, and the Moiſtneſs to it ſelf, and cracketh it very eaſily, and by this may be ſeen that out of a common three-footed pot (uſed for boyling and caſting *Copper* and *Braſs*) in an hour and a half you may alwayes make warm and caſt a *Fluſs* of 12 pounds in a *Wind-Oven*; yea, one may well caſt ſome *Fluſs* out of it, eſpecially, if one have tongs to it, to lift the Pot out of the *Fire*. I was willing to mention this as an Inſtruction, and the form of ſuch *Crucibles* you will find in the following *Sculpture*.

Sculpture·

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Sculpture XXVI.



Deciphered.

1. *The* lower part *of the frame of a* Preſs, *for making* Crucibles.
2. *The ſhape of the whole* Preſs, *and how the* Crucibles *are to be forc'd under it.*
3. *The iron-Rings* or *Hoops about the* Frame.
4. *The ſhape of* Crucibles *to be made in the* Preſs.
5. *The* Handle *by which the* Screw *of the* Preſs *is to be turned.*

CHAP.

CHAP. XXXIX.

Of Cementing, and what it is.

Section 1. CEMENTING is a ſingular fine *ART* through which one may draw and ſeparate from the *Gold*, *Silver*, *Copper*, *Braſs*, and other *Metals*, by a moiſtned *Pouder*, that the Gold may remain ſeparated from its Addition and *Allay*: But 'tis only to be uſed to ſuch *Golds* which are not much more than half *Gold*, for if the *Silver* and *Copper* be more than the *Gold*, to this the other Separations are better, and 'tis done with the ſame in a ſhorter time, and with leſs labour and expence: and according as the *Gold* is rich or poor, the *Cements* is likewiſe to be prepared.

2 But to *Cement* there appertains ſuch *ſtuffs* and matter as will work upon the *Silver* and *Copper*, becauſe of their ſharpneſs, and conſume them as a ſharp *Salt ſpecies*, among which is to be taken *Verdigriſe*, calcin'd *Braſs*, and ſuch like, that they may give a fine and grateful colour to the *Gold*, or elſe *Lapidem Hæmatitem*, *Crocum Martis*, *Tutiam*, or *calcined Vitriol*; which *Ingredients*, how to be put into the *Cement*, is left to every ones Liberty, but he muſt obſerve, that he take nothing which is contrary to the *Gold*, or that may make it unclean and do hurt. The Pouder of *Tile* is to be uſed in the *Cement*, that it may attract what the other Ingredients do ſcarify, and looſen, as *Silver* and *Copper* from the *Gold* with their ſharpneſs and moiſtneſs, which elſe would ſtick and hang about the *Gold*, whereupon the *Gold* becomes fine and clean.

Therefore I have set down some *Cements* which I have used and found very good; But,because in this *Art* of *Cementing* there is necessary a particular *Oven*, which holdeth fire long, therefore I shall first mention how it is to be made, with its *Form*. CHAP. XL.

CHAP. XL.

How the cover'd Oven *for* Cement *is to be made.*

IF one hath much to *Cement*, there is no better way, than to prepare such an *Oven* as in the following *Sculpture*; and although there may be other *Cement Ovens*, yet I conceive that this is the most profitable; for it will hold about 24 hours such a continual fire, that there needs not any attending of it, and it is done thus: Make a square of *Tile*-stones, the inside an Ell wide, and an Ell-high, to the edge (where the *Oven* is to be tapering) and then from the same edge to the Tower of the *Athanor* is to go half an Ell high, and that the Tower of the *Athanor* be an Ell and a half or two *Ells* high, and the inside an Ell and half wide, and so the whole Oven three Ells, or three and a half high, and there must be on the foreside of the Oven two *Mouth-holes*, the lower a third part of an Ell long, and a sixth part of an Ell high, through which the wind may go, but the upper an Ell and half a quarter wide, and so high; and by the same *Mouth-hole* there must lye (in the inside of the Oven) an *iron Grate*, with an edge, as in the next *Sculpture* marked with *Figure* 3. and out of the same *Grate*, before the *Mouth-hole* in the *Oven*, an earthen plate upon which a *Muffle* as high as the *Mouth-hole* is to be placed, and then Section. 1.

CHAP. XL. under it the prepared *Cement* comes to ſtand pure and clean, or elſe the *Pot* with the prepared *Cement* is to be ſet in it without the *Muffle*: you muſt alſo make four *ſmoak-holes* upon every ſide one, as in the next *Sculpture* at *figure* 4.

Section. 2. *Concerning the* Cement oven.

Now, if you will *Cement* in the Oven, and the *Cement* is ſet in, then put in above in the *Athanor* (or Tower) live *Coals*, and fill it after with dead *Coals*; then cover it ſo as no Air may go out of it, onely leave the *Mouth-hole* open (marked with the *Figure* 1.) and the air or *ſmoak-hole*, (noted with *figure* 2.) that the fire may begin, and have air; then ſhut all the other air or *wind-holes* cloſe, and let open only the uppermoſt hole of the *Tower* near the *cover* (noted with *figure* 5.) About the bigneſs of a little finger, that the

3. *Cement* be not too hot, and not to ſuffer any dammage.

In ſuch an *Oven* you may keep a Fire 24 hours, (as aboveſaid) that there needs not much waiting on it, nor caſting freſh *Coals* into it, for the Coals in the *Athanor* will follow one another, and keep the fire all the time in due heat (as you pleaſe). But if there be cauſe to continue the heat longer than 24 hours, then put more Coals into the *Athanor*, and ſo keep the fire as long

4. as is needful.

Now, concerning the *Cement ovens* which have been uſed formerly, thoſe I leave in their eſteem; and when

5. you have try'd both, the Difference will be found.

But if one cannot quickly have ſuch an *Oven* to the *Cementing*, then put the prepared *Cement* between *Tile-ſtones* in a clean Coal-fire, and let it glow its time (as hereafter) but ſo that it may not melt. Thus, you may do all the *cementing*: but be diligent, and careful of the coals: Now the form of the *cement Ovens* may be ſeen in the *Sculpture* following.

Sculpture.

Sculpture XXVII. CHAP. XL.



Deciphered.

1. *The* Athanor *and* lower Mouth-hole.
2. *The* upper Mouth hole.
3. *The* Edge *upon which the* iron Plate *doth lye on the* iron Grates.
4. *The* Regifters *or* Air-holes *above the* Grates.
5. *The* little air-holes *near the top of the* Athanor.
6. *The* ftopples *for the* Regifters *or* air-holes.

7. *A*

CHAP. XLI. 7. *A* Teſt *fitted for the* Athanor.
8. } Cement Pots.
9. }
10. *An* hook *to ſtir the* Coals.
11. *A perſon that attends the Furnace and works.*

CHAP. XLI.

How Rheniſh *Gold is to be* Cemented.

Section. 1. *How to prepare it.*

RHENISH Gold (to cement it either in *Ingot* or *Plate*) muſt be beaten thin, (the thinner the better) and cut it in littles pieces, as broad as *Crowns*. But if it be *Rheniſh Gilders* which you would have *cemented* and clean, then beat them a little thinner, but if there be not much need of that, then beat them whole: Upon ſuch beaten *Gold*, or *Gold Gilders* the *Cementing* is to be done thus, Take

2. *The firſt Cement Powder.*

16 *Loths* of powder of an old *dry Tile* (not too hard burnt, neither too ſandy) then 8 *Loths* of *Salt*, and 4 *Loths* of white *Vitriol*, grind theſe Ingredients all together ſmall, and moiſten them with *Urine* or *ſharp Vinegar*, like *Copel Aſhes*, ſo is the *Cement* powder *prepared*.

Then take that which you intend to *cement*, glow it firſt in the fire,and let it be cool, then ſpread ſome of the *Powder* in a *Teſt* or Pot,which is to be of an equal wideneſs, a finger thick, and lay the *Gold* (which you muſt firſt moiſten in *urine* or *vinegar*)upon the *cement Powder*, one piece near the other,as broad as the *Teſt*,then ſpread upon it again ſome of the moiſtned *Cement Pouder* half a finger thick,and upon it (as now is mention'd)the *urine moiſtned* Gold, lay one lay upon another, until the *Teſt* or

or *Pot* be full, cover it over with the *Cement* pouder the thickneſs of one's Finger, that one may ſee the *Gold:* then put over it another *Teſt*, or cover very well luted, that no vapour or ſpirits may go out; then ſet the *Teſt* (or *Pot*) with the *Gold*, and cement, thus prepared, in a *Cement Oven:* and obſerve, that it may ſtand in like heat 24 hours, and glow brown, that the *Gold* may not flow in the *cement* (to prevent *Dammage*) for, if it ſhould flow in the *Cement*, then the *Silver* and *Copper* which the *Cement* hath extracted, may ſuck in the Gold again, and thereby all pains of beating and *Cementing* will be in vain. CHAP. XLI.

Now, when the *Gold* hath ſtood in the *Cement* 24 hours, then ſhut the *Oven* every where, and let it be cool, then take it out and open it, and waſh the *Cement Pouder* off with warm water, then the *Gold* will be found very near 23 *Carats* on the Content; and if you will have it higher *Gold*, then do the *Gold* over again with another ſingular *freſh Cement* (to which take 16 *loths* of *Tile-pouder*, and 8 *Loths* of *Salt*, and 4 *loths* of *white Vitriol*, one *loth* of *Salt-petre*, and one *loth* of *Verdigriſe*) and let it cement again (as before) 24 hours, do this till the *Gold* is very clean, and high to your delight: It is done well in a few hours, but when you have ſpare time, let it ſtand the 24 hours, 'tis then better and ſurer; But, how much properly every *Cement* makes the Gold better, the proof will ſhew. Section. 3. *This ſecond Cement.*

If one lay *Rheniſh Guilders* whole in the *Cement*, and *cement* it, then there will not only come *ſilver* off from it, and *Copper*, but it will come to be of the Content of the *HungariſhGold*, yet they retain their Impreſſion and Circumſcription, only they become lighter as much as *Copper* and *Silver* have been in them: in this manner is to be cleanſed through the *Cement*, a light *Gold*, in an *Hungariſh* Content: only obſerve, if you have according to 4. *To cement Rheniſh Gilders whole.*

 your

CHAP. XLII. XLIII.

your pleaſure made it higher through the Cement, then you muſt boil the *cemented* Gold at laſt in clear water or lye, until all the *ſharpneſs* come off from it, ſo it will become cleaner, than by waſhing only.

This you muſt do with all Cements, ſo you will receive *Gold* as high as your deſire is.

CHAP. XLII.

Another Cement *upon light or* mean Gold.

Section. 1.

UPON light Gold alwayes the firſt *Cement* muſt be made of two parts of the pouder of *Tyle*, and one part *Hungariſh*, or other *Salt*; but to the other ſhall be taken two *Ingredients*, *viz*. of *Virdigriſe*, *Lapis Hæmatites* and *calcined Vitriol*, as much of the one as the other, and *Urine* boiled very dry and ſmall beaten, thus the *Gold* will become high and fine.

CHAP. XLIII.

A good Common Cement *for all* Golds:

1. *The Ingredients.*

TAKE fourteen *loths* of *Tyle*-powder, 4 *loths* of *Hæmatites*, one *loth* of *Crocum Martis*, one *loth* of *Verdigriſe*, ſix *loths* of *white Vitriol*, and three *loths* of *Salt-petre*; Grind them all ſmall, and the *Gold* with *Urine* moiſtned, and as before after the firſt *Cement*, to be *cemented*, and it gives a very fine *Gold*: Some uſe among this and other

Cements

CHAP. XLIV.

Cements, *Antimony* and *Sal Gemmæ*, this is left to every ones freedom: but Reaſon tells us, That if one *cement* the Gold right, as it may be, with 2, 3 or 4 of thoſe Ingredients, and, that it is not needful to take above 7 or 8 of them, for, I have found it ſo: But, if you will do ſomething more for the *Graduation* ſake, it may be done, for it is certain, That every Gold which is very clean and high, brings his right *Gold-Graduation* and fine *natural* right *Gold-colour* with it ſelf, but one may give the Gold (beſides this) a high colour, that it may excell with this *colour* all other high *Golds*. But in my Judgment, the ſame looks not ſo lovely, as a Gold which hath with it ſelf a high fine *Colour*.

CHAP. XLIV.

More Inſtructions *for* Cementing.

Section. 1. *The Compoſition.*

WHEN the *Gold* is *cemented*, and almoſt clean then ſome do uſe this Method, they put the ſame *Cemented Gold* into an other *Cement* made of four parts of the *Pouder* of *Tile*, one part of *Sal Armoniack*, one part of *Sal Gemmæ*, and one of *Salt*, all ſmall ground together, and the *Gold* moiſtned in *Urine*, and put it into a *Cement Teſt* (luted as above) and clarified 12 hours: until the *Gold* becomes very clean: But why they uſe *Sal Armoniack* among it (which uſeth to touch the *Gold*) I cannot tell: therefore know, That it will not do it *raw*, eſpecially when 'tis mingled with the watery *Salt*, (as here) but it purifieth rather that no other Metal (which is made looſe of the other *Cement*, and yet partly doth hang on it, and in it) may remain.

Then

CHAP. XLIV.

2. *Another way.*

Then ſome when they have much to *cement*, and yet are not willing to beat the *Gold thin*, they put it in a Crucible, and grain it in a water, and when it falleth thin and hollow, (as is mentioned in the *ſilver* work) they mingle ſuch Grains with the *cement* Powder, and cover it alſo with it, that the *graind Gold* be not ſeen, and ſet it in, as they have done with the *Cement* before, and when it hath ſtood its hours, they make the *Grain* clean from the *cement* Pouder by waſhing it with warm water, and ſet it in again, with the freſh *cement-Powder*. But becauſe the *Grains* cannot fall all alike thin in caſting, but ſome are thicker than others, which the *cement* cannot quite bite through, like the thin *Grains*, and then they grain it (when it hath been twice thus in the *Cement*) once more, then it will come among the other again, and the *cement* will work the better, and purify the *Gold*.

Section: 3. *To cement the brickle Gold.*

This manner of *cementing* is beſt upon the light *brickle Gold*, which ſuffers not it ſelf to be beaten. And though the *Gold* muſt be *graind* once or twice (yet tis better, firſt to make the *Gold* deft with much pains) and then to beat it thin: Therefore when the brickle grains are ſet in, once, four or ſix times, and hath ſtood in the *cement*, and is become clean, and of an high content, to thy deſire, then is it deft enough: For all Brittleneſs and uncleanneſs of *Tin* or *Braſs* the *cement* draws out of the Gold; And the *Copper* and *Braſs* is much ſooner and better drawn out of the *Gold*, through the *cement* than the *ſilver*. In this *cement* the Gold ſuffers a great dammage, for the *ſilvers* will ſtill contain the Gold which is melted out of the *cements*.

4. *Another manner.*

One might alſo caſt the *clear* or *light Gold* in thin *leafs* (like as is uſual in the *coin-works* in caſting of ſmall Money) and then to lay the caſt *Ingots* in the *cement* in pieces, which when they are *cemented* twice, and ſo be-

become more deft, then one may beat them a little thinner, and cement them, and follow them with beating and cementing till the *Gold* becom's very deft, and ſo you may beat it thin, and then it will become high enough in the *Content.* By this way the *Gold* may be better holden together, and the *Graind* may be brought out of the *Cement*; and will not go into the *Gold*, nor will any *Gold* come into the *Cement*. CHAP. XLIV.

When the *Gold* is thus made pure by the *Cement* and brought upon the Content, as one would have it, then make it clean from the *Cement* (as above) and do a *Crucible* over with *Borax*, put the *Gold* in it, and let it flow, force it off from the *Bellows* or in a *wind-Oven*, untill it appear very bright, and holdeth the blow, ſo is it deft, then lay a paper anointed with *Wax* or *Tallow* upon it, and while it yet burneth, caſt it in an *Ingot*, which is done over with *Wax*, and is warm, then quench the *Gold* in *Urine*, ſo you will have *fine Gold* and *deft Gold.*

5. *To bring the Cement to profit.*

You may alſo be inſtructed, if you have quite done *cementing*, and haſt much of the uſed *Cements* in which is the *Silver*, and Addition which hath been in *Gold*, then melt the ſame *Cement* with other ſweepings which is not *Goldiſh* through a *melt Oven*, and bring it to profit, ſo that the *Silver* which the *Cement* hath ſuck'd in out of the *Gold* may be made again to profit, for the *Cement* takes no *Gold* to it.

6. *Philoſophick Cements.*

But, as for the *Cement* of which the *Philoſophers* and *Alchimiſts* do write, by which one may change *Copper* into *Silver*, and *Silver* into *Gold*, thoſe I leave to their worth, for ſuch belong not to theſe Cements. For in my Books I write nothing elſe, but what is natural and approved, upon which one may truſt, and not labour upon a vain hope.

CHAP. XLV.

CHAP. XLV.

How to graduate Gold.

Section. 1. *The first way.*

GRADUATING *Gold* (that is to give the *Gold* a higher Colour above its fine natural Colour, to become more red, its right high Gold colour) is to be done thus: take good *Rhenish Gold,* add to it as much *fine Copper,* cast it together, beat it thin, and *cement* it off again that it may have its first *Gold-weight,* then set to the *Gold,* and so much pure *Copper* again, and cast it together, beat it thin again and *cement* it the second time, and so do untill the *Colour* pleaseth thee: By this *Process,* some think the *Gold* may come to such an high *Colour,* that it will exceed the *Copper* in colour, if it were thus cast 30 times with the *Copper,* and cemented off again, only that one must use the *Cement* (written hereafter) which is much better than a common *Cement:* namely, Take the *Pouder* of *Tile* which is well dryed in the *Sun,* and *common Salt* once dissolved through the *Filtre,* purified and once glowed, make out of every one, a part of small *powder* searsed through a hair *sieve,*and then put in *Roman Vitriol,* first rubified, as followeth: Take good *red Vinegar* distilled through an *Alimbeck,* and in this dissolve the *Vitriol,* and purify it through a *Filtre,* fair and clear, and let it evaporate upon warm *Ashes* till you find it fair, then put it in a new *Pot,* set it betwixt Coals, and stir it about with a little wooden stick, till it becomes blood *Red,* let it be cool,and grind it small,and then 'tis rubified: also take *Verdigrise,* and dissolve it in distilled *Vinegar,* and distill it byFiltration, and let it

2. *A very good Cement.*

evaporate,

evaporate, and glow it, as you have done with the *Vitriol*: Take alſo ſo much *Sal Armoniack*, diſſolved in red *Vinegar*: and of theſe now mentioned powders, take of one ſo much as of the other, mingle them well, and ſprinkle them with the *Vinegar* wherein the *Sal Armoniack* was diſſolved, ſo is the *Cement* prepared. Chap. XLV.

Some do write, That one may mingle the *Gold* with the *Copper*, alike in weight, and then to caſt it through *Antimony*, and then blow it off and purify it, and again with the *Copper*, and ſo mingle and caſt it through ſo often till the Gold receives thy deſired high *Colour*: I believe alſo, That if one can have good *Antimony*, that it will give the *Gold* an higher *Colour*. Section. 3. *Another Sort.*

But the common *Graduations* may be done thus, That one may make a Powder of two parts *Copper*, and one part of *Sulphur*; *Calcine* them together till no *blew flame* goes off them, ſo you have a *Graduation Powder*, grind it: and when this Powder is uſed, the *Gold* will be of a little lighter *Content*. 4.

Of ſuch high *Graduated Gold*, and how to be uſed, many of the *Philoſophers* do write, but 'tis nothing to this, for in my Judgment, when 'tis indifferently brought high, it may be moſt convenient for the *Goldſmiths* to uſe for *guilding*, that they may reach the further with it, becauſe of the *Colour*, yet it is free to every one to make Experience of it. 5. *How the Gold ſmiths may Gild.*

CHAP.

CHAP. XLVI.

How to make brickle Gold, deft.

Section. 1.

THIS Labour hath formerly been esteemed a singular *Art* of the *Coin-workers* and *Goldsmiths* and other *Gold-workers*, and indeed it is a fine and useful Art, not to every one known, and is necessary to be know to all *Goldsmiths*: For there are several wayes to make the Gold *deft*, only one is more easy and better than the other. And I will here shew some wayes, which partly I have tryed my self, and out of which every one, according to his occasion may take Instruction, to use that which will be most convenient for him.

2. *Hungarish Crowns or Rhenish Gold.*

When you have the brickle Gold (it may be *Hungarian Crowns* or *Rhenish Gold*) and wouldst make it *deft*, then do it thus: First, Cast the brickle *Gold* into an *Ingot*, then put it in a *Crucible* in a *coyn'd Oven* or before the Bellows, aud give it a strong fire, and observe when the Gold *sweateth*, and will soon flow: Then cast good purified *Salt petre* upon it, so the *Gold* will burn, because of the *Salt petre*, and quickly flow, and as soon as it flows, then the *Salt petre* will quite cover the *Gold*, then you must not drive it hard, so as you may not see the *Gold* under the *Salt Petre*, but pour it out under it, into an *Ingot*, luted with Wax, so is it *Deft*; some use among the *Salt Petre*, *Calx Viva*, it doth the same, and the *Gold* becommeth *deft*.

Salt Petre. *Calx viva.*

But if it should be neglected, that the Gold in the setling in, might flow in the *Crucible*, before the *Salt Petre* were cast upon it, then pour it out again into an Ingot, and

and put it in again, for elſe it will not be ſmooth and *deft* Chap. XLVII.
although you do caſt much *Salt Petre* upon it; but if the *Gold* (as in the Rheniſh Gold ſometimes hapneth) were not too brittle, that it at once doth not become very *deft*, then put it in the ſecond time, and it will become *deft*, although there may be *Braſs* in it.

You may know alſo, That when the Gold ſhall be driven too hard with the *Salt Petre*, and that it appeareth and may be ſeen under the *Salt Petre*, then it is not *deft*, for the *brittleneſs* driveth it ſelf again out of the *Salt Petre* into the *Gold*, therefore 'tis to be obſerved, That the *Salt Petre* be caſt upon it in the right time, and alſo the *Gold* caſt out again, in the right time, and ſo you will have *deft* Gold. Section. 6.

CHAP. XLVII.

Another way to make Gold, *Deft.*

CONCERNING the *good Gold*, or of *Hungariſh Content*, if the ſame be *brickle*, then take a flat *Teſt*, made for it on purpoſe, that the *Gold* may have room upon it, *Lute* it over with pure *Littarge*; and ſet the *Gold* upon it (yet you muſt not ſet in it, at once, above two *Mark*) and ſet the *Teſt* with the *Gold* before the Bellows, and drive it; But if it will not endure the blowing, then add a little *Ball* of good *clean Lead*, and drive it again, until it will endure the *Bellows* and become *deft*, then put it in a *Crucible*, and caſt it into an *Ingot*, and quench it in *Urine*, and ſo the *Gold* will be *deft*, one may alſo cauſe the *Gold* to 1. *By a flat* Teſt.

CHAP. XLVII. Section. flow with *fresh coals*, upon a *flat Test*, and then drive it, and this also doth well.

2. *To bring the Gold clean out of the Crucible.* But if you will cast such *Gold* (if it be good or light) out of the Crucible on a *Plate*, then take a Paper, and dawb it over with *Wax* and *Venetian Soap*, cast a little piece upon it, and while it yet burns, lift the Crucible off, and cast the Gold out under the flames, and so it will remain warm and have no scum, and cast it self clean, that nothing may remain hanging on the Crucible.

3. *When the Gold is brickle by an evil Vapor.* If a good or *Hungarian Gold* becoms brickle, because of an unclean Fire or bad smoak, then it may also be made *deft*, upon a *flat Test*, with the *Bellows*, or one may, when 'tis cast into an Ingot, lay in one of the before written *Cement Pouders*, an hour or two, and so it will become *deft*.

Or melt it with good *Venetian Borax*, and drive it before the *Bellows*, till it endureth the blowing, or in defect of all these Ingredients, if a Gold be only brickle by an evil smoak, then make it deft with *Venetian Soap*, and let the *Venetian Soap* burn upon the Test, then there will remain a *gray Pouder*, which you may use instead of the *Borax*, and so the Gold may be cast clean.

4. Mercurium Sublimatum. Some also cast upon the *Brickle Gold* in the *Fluss*, *Mercurium Sublimatum*, and blow the Gold with it, and it will be *deft* (which is a good way) others on the contrary use *yellow Sulphur*, but the *Gold* must be cast out soon after it, or take *Antimony*, and cause it to flow in a *Crucible*, and when it is flowing, then they cast as much

5. *Sulphur, Antimony, Glass.* *Sulphur* and *Argol* in it, and let it stand so long in the fire, till it becoms a *Glass*, and with this *Glass* the brittle *Gold* is to be driven *deft*.

6. Some of the *Goldsmiths* use a *Pouder*, made of Brass calcin'd and *Verdigrease*, but it should not be so, for both these species are *Metallish* and go in the *Gold*, by which it becomes higher or meaner.

CHAP.

CHAP. XLVIII. Section. 1.

CHAP. XLVIII.

How to make Gold Deft *upon the* Copel.

WHEN you have good *Gold*, set it with *Lead* upon a Copel, and let it be very hot that it may stand pure and clean upon the *Copel*, but before it hardens upon it, put it with the Tongs gently on the *Copel*, that the Gold may simper and quiver; do this till it becoms hard and standeth still, then 'tis deft, but if it harden upon the Copel, before it be moved, then 'tis not deft, but all such Gold receives a *pale colour* of the *Lead*.

2. And although many other Ingredients do make the *Gold* Deft, which are often used of many, yet I will not set them down (for brevity sake) but leave it to every ones freedom, to follow mine or their own Instructions, only I desire they would dilligently observe my meaning, 3. *Alterations*
not only in this, but in all my Books, and not neglect the Work it self, then I hope they will find it right, as they desire, and the Work will judge it self. For such a thing cannot well be so pictured on paper, as thereby to judge and comprehend all out of the writing, but by reading Instruction comes, and by Practice the Experience.

CHAP.

CHAP. XLIX.

How to cast Gold *through* Antimony.

Section. 1. *Through fine* Gold.

IT is an old Invention to cast *Gold* through *Antimony*, so that the Gold by it may be made very clean and fine, and therefore, they have supposed, this to be the only means, and none else besides, by which such may be done. Now this is true (when the *Antimony* is good) that the *Gold* may be brought out very high, and almost fine out of the same, so that it will become the finest *Gold* that is, and no Cement can be made like it. But because *Antimony* is not all alike good, but some much better than the other, therefore the *Gold* becomes some finer than the other: so it is not well to trust to this, that the *Gold* should alwaies come out sure and very clean. And although the casting through *Antimony* be used sometimes upon many Marks of Gold, yet 'tis not taught so, that all such with it may be brought out very fine, and upon the highest Content, but it may satisfy, if it be brought in the quantity, upon the Content of good *Duccats*, for by the higher driving, the *Antimony* comes into the Gold, and without a singular Care in purifying of it, it goeth much more off, than by *Cementing*; therefore the best casting through is upon a little *Gold* (to bring such almost very fine and to the highest) which is done thus. If the content of the *Gold* be of 16, 17, 18 or 20 *Carats*, and you would make it very pure and fine, then take one part of the *Gold* (if it be of a pretty rich *Content*) and two parts of good clean *Antimony* (because the clean *Gold*

Gold is ſooner to be caſt through) put it together in a a Crucible, blow it, let it flow, and when well flown together, then pour it into a warm *Cup*, made of *Iron* or *Braſs*,and greaſed with *Tallow* or *Wax*, let the *Antimony* and the *Gold* be cool in it, then you muſt turn theCup, and daſh it upon a ſtone, whereby the *Antimony* may go together with the *Regulus* (which hath ſetled below and looks of a gray-*yellow* colour) and be eaſily beaten out.)But that you may bring the *Gold* upon the higheſt Content, caſt ſuch *Regulus* once or twice more with *freſh* *Antimony*, and at all times into the *Cup*, after ſet the *Regulus* upon a flat *Teſt* in the fire, blow to it, and it will melt quickly, but blow with the Bellows very gently, ſo that it may juſt blow upon the *Gold* in th *Teſt*, and do this until the *Antimony* be evaporated, again very clean from the *Gold*,and that the *Gold* do endure the blowing well, and becomes *deft*, then let it be cool, and quench it in *Urine*,caſt it then to thy pleaſure, ſo you have very fine and high *Gold*, which is judged *fine Gold*. CHAP. XLIX.

Section. 2. *To caſt through poor* Gold.

But if the *Gold* be poor upon the Content, or very light, then take more of the *Antimony*, and add to a *Mark* of *Antimony* 4 *Loths* of *Sulphur*, and caſt the *Gold* through with it, as hath been ſaid, and put in the *Regulus*with freſh *Antimony*, the ſecond and third time without the *Sulphur* : Laſtly, drive it upon the *Teſt*, that the *Gold* may become very clean : you may alſo take to ſuch caſting through, upon every *Mark* of *Gold*, 4 *Loths* of *Copper* or *ſcales* of *Copper*, ſo it will receive a fine *colour* from it,but when you take *Copper* to it then take the more *Antimony* that it may conſume it and the Addition.

3. *Another upon light Gold.*

Some uſe to the caſting of light *Gold*,which containeth of it, from 12 to 18 *carats*,a ſingular *Powder* of one part *Sulphur* the other *Antimony*, and one part of prepared

CHAP. XLIX. *Caput Mort.* and take to it of *Mark Gold*, 12 *Loths:* let it flow well together, then cast it into the Cup, and beat the *Regulus* from the *slacks*, and cast it with half so much *Antimony* again twice or thrice, then drive it upon a *Test*, so you have good high *Gold.*

Now, how the *Cup*, *Ingot* and other *Instruments* to the casting through are to be formed, the following *Sculpture* will shew.

Sculpture XXVIII.



Deciphered.

1. *The* Form *of the Common* Cup, *cast in Brass.*
2. *A* Cup *made of* Smiths work.
3. *A* Crucible *for the Work.*
4. *A flat* Test *for it.*
5. *The* Ingot.
6. *The* Plates.

7. *Of* Antimony *with a* Gold Regulus.
8. *Of* Antimony *when the* Gold Regulus *is beaten from it.*

Section. 7. *To lay the* Gold *which is cast through the* Cement.

When the *Gold* which is come out of the casting through, is blown clean, yet it may retain a smack of the *Antimony*: to prevent this: Beat the *Gold* very thin, lay it in a particular *Cement* made on purpose, as is mentioned in the Description of the *Cements*: Let it stand some hours in it, so it will extract such also, and becomes clean.

CHAP. L.

How the Blick *or* light Gold, *containing much* Silver, *is to be separated.*

THE *Silvery rich Gold*, especially that which comes of from melting, of which a *Mark* contains from 9, to above 12 *Carats* off fine *Gold*, this is to be separated thus: Grain it in a boyling Water (as above is said of the fine, thin and even *Silver*) then prove it, so as it hath a like Content, then take the Grain'd and moisten it with water, and take to every *Mark* (of the above-mentioned Pouders) 12 *loths*, of good *yellow Sulphur*, and mingle it with them, and put it in to a *glazed Pot*, luted with a cover, and make a fire round about it, till the *Pouder* on the *grain'd* be well flown; let it cool, then beat the Pot in pieces, then take and put the *grain'd* into a Crucible, set it in a *Wind-Oven*, let it flow very well, and cast upon it a little ground *Sandover*, mingled with *grain'd Lead*, let it stand a little longer, then pour it into a warm *luted Iron Mor-*

ter,

CHAP. L. *ter*, and if much of it ſetleth to a *Regulus* on the bottom, and the Silver becomes a *ſcorias*, then beat it off from the Gold *Regulus*, which will be *yellow* and *gray*, but becauſe the *Silver* of the firſt *Fluſs*, will not all come into the *ſcorias*, therefore grain the *Gold* once more, and prepare it with the *Pouder*, and let it flow, and pour it again into the *Morter*; Laſtly, take the *Gold*, and caſt it through only with the *Antimony*, blow that which is caſt through upon a *Teſt*, and caſt it clean, ſo you will have good and *Deft Gold*; This *caſting* through, is a way if one have need of the Gold in haſt, elſe there are other and better ways, namely, when the *Gold* is caſt once or twice with *Sulphur*, that it may be driven *deft*, and then caſt into an *Ingot*, then *beaten* thin and *cemented*, whereby not ſo much will go off from the Gold, but it requires greater time.

Section. 2. *To caſt the uſed Antimony.*

The uſed Antimony, through which you have caſt at laſt the Gold, retain ſingly, and put it again in a Crucible, and let it flow well, and add to it filed Iron, ſo much, that the ſtirring-hook with which you ſtir it about, may no more be touched, ſo the *Antimony*, eats it ſelf weak on the Iron, (which it doth eaſily touch) and doth let the Silver and Gold fall, as much as it hath with it, then pour it into a Morter, and according to the quantity, the *Regulus* will ſettle it ſelf on the bottom, this retain ſingly or apart.

3. *The* Iron *takes the virtue of the Antimony.*

4. *To beat down (through caſting) the* Scorias.

The *ſcorias* which is come from the firſt caſting (as above is mentioned) put likewiſe into a Crucible, and beat down the *Silver* in it with *grain'd Lead* and *filed Iron*, as long until the *ſcorias*, with the Iron Hook (that ſtirreth it about) toucheth no more, by this time, almoſt all the *Silver* will fall down, and of this *Silver*, retain alſo a part.

The remaining *ſcorias* with the *Antimony*, which is left out of the Silver and Gold, (as now ſignified) being

ing precipitated; take them together and put the *Lead* upon a *Flat Test*, or in an *unglazed Clay Dish*, set two of them within one another, and when it is entred, then let it go off upon a *Test* (as is usual) and observe when the entred *Lead* begins to drive upon the *Test* and goes clean, then put the *Silver Regulus* (which is fallen out of the *scorias*) upon a *Test*, that it also may go off clean, and then this *Silver* Proof upon Gold, will shew how rich it is in *Gold*; also prove the *Regulus*, which is fallen out of the *Antimony* upon Gold. If now the same *Regulus*, (which before by it self is to be burnt upon a *Test*) be not very rich in Gold, then put it also among the Silver, and separate it apart in *Aqua fort.* and you will hardly find a nearer way to make such Gold clean: and although this Instruction looketh as if there were an Ambiguous way, yet it is not; but when one is in work, then it goeth soon to an end; for the Gold, thus with the *Sulphur* and *Antimony* prepared, floweth easily, and thereby many castings may be done in a day, or in half a day; yet every one may require a consideration, how the best is to be done.

CHAP. LI.

CHAP. LI.

How to separate the used Antimony.

Section. 1. *To Refine Antimony.*

IN regard that the burnt *Antimony* keepeth back somewhat of *Gold*, yet there remains *Gold* and *Silver* in it, now to bring this clean out of it (which is called to refine the *Antimony*) do it thus: Put the used Antimony together, in a Crucible, and if it be a pound, then add 4 *Loths* of *filed*

 Iron,

CHAP. LI. *Iron*, 1 *Loth* of *Copper*, 4 *Loths* of *Lead*, and 4 *Loths* of *Littarge* to it, let it flow well together, then cast it into a Cup, or let it cool in the *Crucible*, then set the *Antimony* again in the *Crucible*, and beat it down with a little *grain'd Lead* and *Littarge*, and cast upon it

2. *To precipitate it.* *melted Salt*; let it stand well in the Glass, and cast it into the Cup, then drive off the *Regulus* which cometh out of it, upon a *Test*, then you will receive the *Gold* and *Silver*, as much as the Antimony had retained; this you may cast once more through with fresh *Antimony*, and so the *Gold* will come out, yet the *Antimony* will retain still some of the *Gold*, (which comes in the *Silver*, made out of the *Antimony*) and this is to be separated in the *Aqua fort*. and if it be too rich in *Gold*, then must be added to it, *fine Silver*, that the Water may touch it.

Section. 3. But some do use the parting of the *Antimony* thus, they take a part of *Antimony* and one part of *Vitriol*, one part of *grain'd Lead*, one part of *Salt Petre*, three quarters of *filed Iron*, and a *little Copper*; and this they put into a *Test*, and let it *evaporate*, so there will remain among them another *mixt matter*, to this they add (according to the quantity of the *Antimony*) more fresh *Lead*, and boyl it clean up, then drive the Lead off upon the *Test*, and so will it find in it self the *Silver* and *Gold*, which the *Antimony* hath had by it self.

4. *Rich Antimony.* When the *Antimony* is very *Rich* in *Gold* and *Silver*, then may it be made pure, as followeth (and it is the best cleansing, only that it taketh much labour and somewhat longer time) Take the *Antimony*, put it upon a *Test*, let it flow well, and add to it filed *Iron*, and stir it about always with an *Iron*, and cast as much of the *filed Iron* into it, until the *Iron*, with which you stir it, touch no more the *Antimony* (as before mentioned) which is then very easy to be seen; then add to the same *Antimony*,

mony, *Lead*, and boyl it clean up, by this addition of the *Iron*, the wildneſs is taken away from the *Antimony*, ſo that then (which is very eaſily boyled up) it will go clean off upon the *Teſt*, and will not work upon the *Teſt*, which is a good way. CHAP. LII.

CHAP. LII.

How Gold *may be made fine and clean through* Aqua Regis.

BECAUSE the *Aqua Regis* toucheth only the *Gold* and not the *Silver*, therefore I judge the *Gold* may be made pureſt and fineſt by this way. Take good *high Gold*, ſet it upon a good *Teſt*, made on purpoſe for it) let it go off upon it, with clean Lead, that you may be ſure no Copper remains in it, then blow the *Gold* upon the *Teſt*, unleſs it become deft, then beat it thin, glow it, and then put it in a good and well luted *Glaſs Bottle*, pour upon it *Aqua Regis*, and diſſolve all the *Gold*, and what will not diſſolve but remain in the bottom of the Glaſs, that is no *Gold*; then pour the *Aqua Regis* (in which the diſſolved *Gold* is,) clean off, and put it in another glaſs Bottle, and draw the water from it, then the *Gold* will remain in the glaſs Bottle; caſt it together and blow it clean, and this *Gold* thus prepared may be judged, as *fine Gold*, becauſe the *Aqua Regis* toucheth nothing but *Gold* and *Copper*, and if the *Gold* be firſt made clean from the *Copper*, upon the *Teſt*, then can nothing elſe but *pure*

CHAP. LII. *pure Gold* come out of the *Aqua Regis*, but how much good *AquaRegis* (as I have ſaid) is to be made, of this, you have been ſufficiently inſtructed before.

Thus much (Courteous READER, *I was willing to deſcribe of the* Gold Oars *and their Labour, as a furtherance to Experience, and for the uſe of common* Mine-Workers, *and yong* Aſſayers, *and ſo leave it to further Conſideration.*

The END of the ſecond Book.

Chap. I.

OF
Copper OARS.

BOOK III.

CHAP. I.

How to know Copper Oars.

THIS *Third Book* describeth *Copper Oars*, and how they are to be known, and then how to assay them, as also of the *Black Copper*; and lastly, how the pure *Copper* is to be tryed, and also how after the *High Dutch* and *Hungaian* manner the *Silver* is to be *refined* out of *Copper*, with *Instructions* annexed of a singular new way to *refine Copper*, and how *Brass* is to be made out of *Copper*, and how *white Iron* may be made *Copper*. Section. 1. *The Purpose of this Book.*

Now, *Copper Oars* are more easily to be known than any other *metallick Oars*, as having in them varieties of *Colours*, so that many more delicate colours come out of them then from any other *metallick Oars*. And of these there are three sorts. 2. *Coper Oars yield fine Colours.*

First, *Copper Glass*, and this is to be numbred among the *deft*, and *smooth flowery Copper Oars*, for the *Copper-Glass Oars* which are *blewish*, (and yet their colour come near to *Grey*) are the richest *Copper Oars*, and contain the most *Copper* and *Silver*, and yield *deft* and *good Copper*. 3. *Copper Glass.*

CHAP. I. Section. 4. *Green and lazure Colours.* Secondly, the *green Coppers* which are rich in *Copper* but poor in *Silver*, alſo the fair *lazure colored Copper* or *blew* and *Green-mixt-copper-Oars* contain likewiſe much and good *Copper*, but generally very little *Silver*.

5. *Brown Copper.* Thirdly, the *brown copper Oars* (like an *iron Vein*) if they be either harſh or mild, yet they are found *rich* in *Copper* but poor in *Silver*: likewiſe alſo the *copper ſhiffers* (in which there are Characters or *Figures* of *Fiſhes*, *Snails*, and other Reſemblances and repreſentations of corporeal Creatures) and alſo rich in *copper*, and commonly do contain *Silver*. called *Gamahes.*

6. In brief, all copper *Oars* and *ſhiffers* that have no flinty, ſpeizy or other harſh matter within them, are to be reckoned among the *ſoft flowing Oars*.

7. *Copper flint.* But there appertains to the *harſh flowing copper Oars*, the harſh *copper Flint*, and what is *ſplendy*, *miſpickly*, *glimery* or *ſpady*, as alſo all flint Oars by themſelves without any other *Oars* mingled with them, or *ſhiffers* in which the *copper flint* doth ſtand ſtreamingly intermixed.

8. *Copper ſtone.* Alſo the raw *ſlack ſtone*, *copper-ſtone* (Oven-breachers occaſioned from melting ſuch raw Oars.)

Now, as the *ſilverOars* are known before the proving and melting, (as to their natures) and how they may do in the *fire*, ſo it muſt be known likewiſe with the *copper Oars*, that one may help them in proving and melting: And becauſe they differ, therefore the *raw*, *unflowing copper oars* do not prove like the *weak flowing and milde*, as will follow in my Inſtructions, but it muſt firſt be ſhewn how the *Aſſay* Crucibles alſo the *little* Ovens for proving *copper* Oars are to be made, (and in caſe of neceſſity) that an *Aſſayer* himſelf may prepare his ſtuff and *Inſtruments*.

CHAP.

Chap. II.

CHAP. II.

How to make Crucibles and Ovens to prove Copper.

SO the *copper Oars* which are to be proved for *Copper*, one must have little and good *Crucibles* for them, which the *Goldsmiths* do use: But, because they are not to be had in every place good, and in a fit *Mould*, therefore I Judge it convenient, That every *Assayer* do make such himself. Section. 1.

To the making such *Crucibles*, *Frames* or *Moulds* of *Brass* are necessary (or of *Pear*-tree wood, so that one may put on it an *Iron ring*, that the Mould may not be so apt so break.) 2. *Crucible form.*

The stuff or clay out of which you intend to make such *Crucibles*, prepare them of *Potters Clay*, like the *Tests* for making Proofs of *Silver* Oars (as is before signified) then take a Ball of such *Clay* (as much as you think fit) and press it into the frame or mould, so that the *Clay* on the sides may well go up and in the middle remain a pretty deep hole: after the manner that the *Crucible* is to be: then anoint the upper part over with *Bacon*, or *Oyl*; and put it into the *Frame*, in which the *Clay* is to be pressed until it toucheth the top of the *Frame*, then turn the upper part of the *Frame* downwards, and that which is put in will easily be drawn out again; and thus the *Crucible* is formed in the frame, as it ought to be, set also the frame (while the *Crucible* stands yet in it) a little while before the Sun to be warmed, then the *Crucible* will go out very well and sound, and, although it might be pressed out otherwise, yet it can- 3. *The Clay.*

CHAP. II.

cannot be done ſo conveniently as when it hath ſtood a little near the warmth, becauſe thereby the *Clay* doth ſhrink, ſo that the *Crucible* by that heat may well fall out of it ſelf.

But why the lower part of the *Frame* muſt not be faſtned, the reaſon is, that the *Crucible* may be lifted out of the upper part of the frame, and it could not be brought off again without ſpoil, therefore it is better the lower part remain ungreaſed, that the *Crucible* may be brought out whole. But when the ſtuff is made very brittle, and the *clay* not faſt, then annoint the lower part with fat, and the *Crucible* will eaſily be brought out with your fingers,and ſo remain whole.

Thus they make Aſſay-*Crucibles*, and when they are well dryed, let them burn in a *Potters-Oven*, or a *Tile-Oven*, yet let them not be ſet in too ſtrong a heat (leſt they melt)and they muſt be taken out in time.

Section. 4. *Little Ovens for Copper. Proof.*

But what concern the *little Ovens*, (wherein they uſe to take the *Copper* proofs) the beſt are prepared of *Potters* ſtuff or *Clay*, to be ſet and uſed at pleaſure: and make them thus, Take the prepared *Potters-ſtuff*, and form of it a little round-*Oven*, the *diameter* nine inches wide, with which the *Proof-Oven* uſeth to be divided, (of which *Inſtruction* is given in the firſt *Book*) and 12 inches high, and in the midſt a Belly of 11 Inches, and no bottom below, yet it muſt be an Inch and half thick, and as much as the clay ſhrinketh, ſo much muſt be added again, and whilſt 'tis yet ſoft, it muſt be cut in the edges, that one may put *Iron-hoops* about it, and with Croſs-*Bars* joyn the upper and lower *Hoops*, or elſe it will very eaſily fall aſunder: Now, when this Oven is very well dryed in the Sun (or warm place) then let it be burnt hard in a *Potters* or *Tile-Oven*,and lute it well about with the *Iron-hoops* and *bonds* (as has been already taught)

After

After this make a foot with a bottom, to this *Oven* of *Potters ſtuff*, being three ſquare fingers deep within, and juſt ſo broad as the little Oven below, having a hole in the ſide, as wide as the breadth of a large Finger, through which the *Bellows* is to blow (as you will hear hereafter) and there may be an edge within the top upon which you may lay a little *Iron-Grate*, as in the *Sculpture:* this foot muſt alſo be burnt in a Potters-*Oven*, and bound about with *iron-hoops* and *bonds*, as the *Oven:* then lay the *Iron-Grate* in it, and ſet the Oven upon it, then 'tis prepared as it ought to be. CHAP. II.

Now, when you will prove in it, ſet it upon the Grate,in the little Oven, on a little foot made of *Poters Clay*,which muſt be three ſquare fingers high, but not full three fingers broad above, upon which the *Crucible* is to ſtand with the Proof.

Alſo there muſt be little *Covers* to the *Copper-Proofs*, which muſt be put to, or luted upon the *Aſſay Crucibles:* and they muſt alſo be made of *Potters-ſtuff*, and burnt as the other, but not by a ſudden heat leſt they crack: and be careful to cover the *Crucibles*, that no Coals or uncleanneſs fall therein,whereby the proof may become falſe.

Section. 5. *Another Form of a little Oven.*

There may alſo a *little Oven* be made,juſt in the form and wideneſs as before, only that it have a Bottom and be 14 *Inches* high from the bottom,and that two inches from the bottom there be two holes quite through it, in which you muſt fix two *Iron Bars* a finger thick,and lay upon it a little *iron Grate* (like that before) and under the *Grate* let there be made a hole of a finger wide for the *Bellows*, This little *Oven* which alſo muſt be *Hoopt* about with *Iron*, and is in all things like the other only this is whole,but the other may be taken aſunder in two pieces.

6. *A little Oven of Tiles.*

In caſe you want *Bellows* to ſuch *Ovens*, there is ano-

Chap. II. ther *Oven* to be made, in which the proofs may be proved: thus, Take burnt *Tiles*, joyn them together in a ſquare, about a ſpan wide, with good *Clay*, and *lute* the joynings with it, and leave a *Wind-hole* before, as wide as the *Oven* is, a *Tile* and half high, and over the *Wind-hole* in the Oven, lay a little *Grate* of *Iron*, and four ſquare *Bars*, a finger thick, and a ſpan high from the *Grate*, ſo is your little *Oven* prepared, but before you prove in it, you muſt glow it with fire; that it vapour not in proving, then ſet upon the little *Grate* a little foot, for the *Crucible* to ſtand on, and when the *Crucible* with the proof is ſet in, and coals and fire put upon it, and that it grows warm, then fan in ſome air with a wing, by the *Wind-hole* in the little *Oven*, ſo the wind will aſcend through the *Grate* into the fire ſtrongly, and the *Copper-Proof* will boyl it ſelf up in the *Crucible:* This is an eaſy way for preparing this little *oven*, but you muſt obſerve to do things exactly, that the *Proof* may be compleat in the fire.

Section. 7. *Proof of* Furnaces.

There are alſo uſed to the *Copper Proving Furnaces* (ſuch as *Gold-ſmiths* have) to boil up the *Proofs* before the *Bellows*: but I judge becauſe the blowing in the *Furnace* goes but on one ſide of the *Crucible*, therefore the Proofs cannot be ſo well boyl'd up on all ſides, as with *Bellows* which go from below upwards. Alſo when the *Bellows* blow but on one ſide, the *Crucible* is apt to break, eſpecially when 'tis not good: therefore how the above-mentioned Ovens are to be formed within and without, is ſhewed in the *Sculpture* following.

Sculpture.

Chap. II.

Sculpture XXIX.



Deciphered.

1. *The* inſide *of the little* Oven *made of* Tiles.
2. *The ſame, when it's cloſed.*
3. *The foot of the* Crucible *upon the* Grate.
4. *The* little Oven *of* Potters-Clay, *bound with Hoops.*
5. *The* foot *of it.*
6. *The* iron Grate *in it.*
7. *The* Crucible *upon the* Grate *with the* proof *in it.*
8. *The* Wind-hole *through which the* Bellows *are put.*
9. *The Whole little* Oven open *with the* Bottom.
10. *The* Iron-hoops *which go about it.*

11, 12, 13 } *The* Bellows, Bruſh *and* Inſtruments.

CHAP.

CHAP. III.

CHAP. III.

How to make a Fluſs *to prove* Copper Oars.

TAKE two parts of *Argol*, and one part of *Sulphur*, grind them ſmall and mingle them, put it in an unglazed Pot, then put live Coals in it, when it begins to burn in the Pot, let it burn till it gives over of it ſelf, let the Pot be cool, ſo the *Fluſs* is prepared; then take it out of the Pot, put the Coals away, and keep the *Fluſs* ſmall ground in a warm place, ſo it will remain good; for, if it be ſet in a ☞ cool and moiſt place, it will turn to *oyl*: or, take the pot, let it be warm, pour the *Fluſs* into it, and cover it; thus the *Fluſs* will kindle it ſelf in the pot, and burn out: this *Fluſs* is to be uſed to good and *deſt Copper* Oars: But what be *flinty*, and other Oars which are *hard* to ſeparate, to ſuch this *Fluſs* is too weak, and there muſt be ſomething added to it, as you will hear in the *ſequel.*

CHAP. IV.

How ſoft flowing Copper Oars *are to be proved.*

RICH *ſmooth-flowing* and good *copper Oars* (which are not flinty and *ſpeizey*) prove them thus, Grind the *Oar* ſmall, and weigh of it with thy proof-weights two Centners, and put them in a Crucible, and three times ſo much of the be-

before mentioned *Flufs*, both well mingled, and cover the *Crucible* above the *Oar* and *Flufs* with common *Salt* a full finger thick, prefs it down and cover the *Crucible* luted with *Clay*, that it go not off, nor Coals fall therein, and make a fire in one of the faid little Ovens, fet the *Crucible* upon the little foot, cover it with Coals higher than a hand breadth, let it be warm, and blow through the hole under the *Grate*, that the wind may go alike round about the *Crucible*, and let it ftand a while in the *fufion*, fo the proof will boyl clean up, and if the *Crucible* doth not break, then take the upper fire off and lift the *Crucible* hot, out of the Oven: fet it upon a plain *Tile*, that if the *Grains* of Copper be not run altogether, it may be helpt: Then let the Crucible cool, open it, and in the bottom you will find a *grain* of Copper which is fine. For thefe good fmooth *Oars* will yield fine *Copper*: Then draw it up with thy proof-weights, and try how many pounds of *Copper* a *Centner* of Oars doth yield. But you muft obferve in the proving, that you drive not the proof too hard in the *Crucible*, for the Copper will burn, and drive it felf very eafy in the *flacks*, as one may fee in the *flacks*; (which will foon receive the colour of the *Copper* Oars) for when they are very red in the *Crucible*: then the *Copper-Proof* is driven too hard, and the Content is lighter, but if the *flacks* are *brown*, then the Proof is made.

CHAP. IV.

CHAP. V.

How hard flowing Copper Oars *are to be proved.*

Section. 1. *The manner of it.*

HARD flowing *Oars* are not to be proved as the ſmooth, but in another manner: thus, Take the *Copper Oars*, beat them as ſmall as the Seeds of *Hemp*,and and mingle them together: weigh two Centners of it in the proof-weight, put it in a proof-Teſt, ſet it in a proof-*Oven*, give it a very gentle fire, that it may begin to roaſt it ſelf, then ſtir it with an iron about the *Teſt*, elſe the *Oar* will turn to *Aſhes* together in the *Teſt*, and will not roſt: and when 'tis ſtir'd the firſt time, then give it a little ſtronger fire, that it may glow well, lift it out of the *Oven*, and let it cool, then put it in the *Oven* again, and let it roaſt again untill it hath done ſmoaking (and ſmells not of *Sulphur*) then grind it a little ſmaller, yet not ſo ſmall as Mill-duſt, and roaſt it again till it ſtinks no more *Sulphuriſh*, then ſtir it once or twice with the little hook, that it may not be aſhes again.

2. *The Oar burnt quite dead.*

When 'tis thus ground anew, and waſh'd the ſecond time, let it cool, and ſet it the third time in the Aſſay-*Oven*, then roaſt it, and grinde it very ſmall,then waſh it once more that it may be burnt quite *dead*,then grinde it again very ſmall, ſo is it prepared for the Proof. Then divide the *Oar* upon a Ballance in two equal parts,and put one part in an *Aſſay-Crucible* with 3 times ſo much of the foreſaid *Fluſs*, and with a fixt part of *flowing Glaſs-Gall*, mingle them well in the *Crucible*, and cover it with common or *flowing* Salt (as in the proof before) and

and lute it over on the top with *Clay*, that the Cover be faſt, ſo that no Coals may fall in, then ſet it in a little Oven, blow the *Bellows*, give the proof a ſtrong ſudden fire (a little ſtronger then the former proof) and when the proof hath ſtood in a pretty good *Fluſs*, then lift the *Crucible* out of the *fire*, and let it cool, and break it, and ſo you may find in the bottom a *Grain* of *black Copper*, of ſuch Goodneſs as the *Oar* and *Flint* is in the melting, and may thereby get *Copper*, which is the right proof of it. CHAP. V.

Yet there is of one ſort of *flinty Oar*, fairer *Copper* than of another, and commonly all *flints* which are of an *iron* Nature) yields *iron ſtreamy* Copper, therefore they are not to be uſed for making of *Braſs*. Section. 3. *Some Copper not fit for Braſs.*

Of this *graind Copper* (as it comes out of the Proof) weigh it with a *Centner weight*, then you may ſee how many pound of *black Copper*, a *Centner* of *flint* or *raw Coper Oar* do yield, ſo you may eaſily reckon how many ſuch *Centners*, do afford one *Centner* of *Copper*: and know therefore, that if you do weigh two *Centners* of *flinty Oars* to the proof, if the proof ſhould be amiſs, then you have a Centner more of the roaſted Oar or *flint*, to make another proof, otherwiſe it will be a great hindrance to roaſt but one *Centner* to the Proof.

But on the contrary, the old *Aſſayers* have uſed this Method, and proved every *Copper Oar* or *flint* upon pure *Copper*, and thereby know how many *Centners* of it, will yield one *Centner* of pure *Copper*: this I believe to be a juſt proof for them, who have roaſted and purifyed the *Copper* themſelves. But thoſe who work the *Silver* in it, and ſell it with the *Silver*, it is better for them to know how many Centners of *black Copper* they may have in a *roaſt*, ſo they may know how many *Loths* of *Silver*, a Centner of *black Copper* contains.

And among all meltings, the Operation of Copper

upon

CHAP. V. ☞ Section. 4. *To boil Oars for Copper.*

(upon which is to be made a proper Account) is the most pleasant and fairest Experiment; for if the Proof be right, then what is produced will be so too.

Therefore, if you will (with the old *Assayers*) prove the Copper-Oars upon boiled Copper, do it thus, Grind the *Oars* small, weigh of it two Centners: if they be unflowing or flinty then roast them (as above) in an Assay-*Crucible*, and weigh to it four *Centner* of *Fluss* or *Lead-glass*, made of *Littarge* and *Flint-stones* (as in the first Book of *Silver Oars*) and mingle them well, and cover it with *Salt*, and also cover the *Crucible*, and set it in a little *Oven* before the Bellows: and let it flow like another Copper-*Proof*, and when 'tis cool open the crucible, and in the Bottom is the *Regulus*, among which is copper, and lead together, put it upon a flat *Test* luted with *Littarge*, drive it till the copper appears to be of a clear Green, then lift the *Graind-copper* from the Test, and quench it in Water, and weigh it with thy *Proof Weight*, so you may finde how many pound of boyled copper you have from two *centners* of *flinty-copper Oar* in the Proof: one may also very easily burn the *copper*, especially if the Oar be poor in *copper* (as you may finde by the Operation). Therefore I conceive it better, to prove the *copper* Oars first upon *black copper*, and then upon boild copper: and this way, the Proof of the light contenty *copper Oars* cannot so easily be hurt.

CHAP.

CHAP. VI.

How to prove light Coppers.

Section. 1.

POOR *copper-Oars* (especially the copper Flints and copper-Glass which are in the Mountains or in light *shiffer* Mines) they must be proved thus; Take a common Proof of the *Oar*, grind it well, and weigh with thy Proof weight twenty or more centners, and draw it in a Vessel, so that therewith the light *clay* may be separated from the pure *slick* and *copper* Oars; weigh the *slick* which comes from it, thus, and mark how many centners yields a pound, that you may know how many *centners* of raw Oar (from the Rock or vein in the Mine) do yield a clean *centner*.

Weigh then two *centners* of such pure *slick*, and put them in an *Assay-test*, to be roasted in an *Oven* (as you have done with the copper *Oars*) but that the proof may not be false, (because the *slick* doth use to sparkle in the first setting of it into the great heat, especially if *pibbles* be among it,) therefore cover the *Test* wherein the weighed *slick* is, with another *Test*; let it remain thus covered till the *slick* glow well; then take off the upper *Test*, and roast the *slick* (as you are instructed before) and then grinde it very small, and divide it into two equal parts, and mingle one of them with the *Fluss* (appertaining to the copper Oars) and put it into a *crucible*, covered with Salt, and do as you have done above with the harsh *copper Oars*, and you will find in the bottom of the *crucible*, a grain of *copper*: then weigh this with your Proof-weight, so you may know out of how 2.

CHAP. VI. many *centners* or quantities of ſuch *raw*, *rocky* or *waſh-work* you may make of a *centner* of black *copper*, which grain'd *copper* you may prove afterwards for *Silver*, and find the Content, and maiſt order thy matters accordingly.

Section. 3. This proof upon poor mixt *copper-Oars*, I have put here becauſe experience manifeſteth, That the *Copper* Oars do not break throughout clean upon the *Veins*, but have much *flint* and ſubtil *copper-glaſs* mingled with them, yet in the waſhing they do willingly ſeparate from it, and bring it into ſuch a compaſs that one may know that all the reſt of the Oars from thoſe Veins may be wrought to good profit, which could not be, if they ſhould be melted raw.

4. Concerning the poor *Shiffer* which contains very little *Copper*, they cannot well be brought into compaſs, for they riſe for the moſt part in the Water, and are *fugitives*, although ſome do ſeparate in the water, and afford a *ſlick*, and thus they may be brought into *compaſs*, and may be thus proved, and made to profit like the other *Oars*.

5. Then the *Copper-flint* will ſtand apparently mixt and ſtreamy, in ſome *ſhiffers* which are to be proved either raw or among others, or the *ſhiffer* apart whereby it may be found what *copper* the *Shiffer* doth yield, and the melting ordered accordingly.

6. The other mixt *copper-Oars* (as *Laſure Copper green*, or *brown rich copper-Oars*) cannot be well ſeparated in the water from their mixtures, for they are very light, and run not in weight, like the other flints, but go forth in the water, therefore ſuch are firſt to be proved for *Silver*, if they have none (as commonly they are poor) then tis not much to try, but if they contain *Silver*, glow them hard, and ſuddenly quench them in cold water, then the *inſperged* or mixt *Copper Oars* will run

run together in little *Grains* (as above is ſignified of the *Gold Oars,*) then waſh and grind them ſmall, and draw it into a *ſlick,* and when it ſeparates, then you may in the great Work according to the quantity of *ſlicks* regulate your ſelf. But how theſe copper Oars are to be dryed in the little *oven,* you will be directed hereafter.

CHAP. VII.

How light Copper Oars *which are mixt and inſperged with flint, may be brought to* profit.

THE *light flinty inſperged* copper Oars (by reaſon of their hardneſs and unflowingneſs) cannot well (in a great quantity) be melted throughly, or brought to profit (the flint being ſo hard, and before it becoms ſmall enough in the Beating) it makes inſperged *oars*, ſubtil, and riſe in the water: therefore there can no ſurer or better Method be found for ſuch *Oars,* than to roaſt them in an high roaſt *oven,* made on purpoſe, (as before is often mentioned.) And when it burns to a great heat, pour water upon it, and let it cool ſuddenly, ſo the *frighted Metal* will run together in *grains* in the *flints,* which are heavy, and remain faſt by ſetting them in the water, and then they may be waſhed and ſeparated, and that which is not clean *Copper* will be a good and heavy Copper-ſtone, that ſo the flinty *copper* Oars (when they are *roaſted* and are brittle) may very eaſily (in a great quantity) be *buok'd* through, and the Metal which is gathered may be waſhed, or ſo much of it, as in one gathering can be melted throughly (like raw *Oar*) which is to be made into ten or more equal

CHAP. VIII. equal parts. And the roaſt *Oven* which is to be uſed to this Waſhing, may be formed (as in the firſt and ſecond Book of *flinty Gold Oars*) are more fully deſcribed.

CHAP. VIII.

How to prove Copper Oar *from* Copper-ſtone.

IF one would try and prove *Copper oars* eſpecially the *flinty* (containing much or little *Copper*, called *raw ſlack-ſtones*, or *raw Copper-ſtones*) you muſt do it thus; Grind the *Copper oars* or the *flint* ſmall, weigh from it two *Centners*, put them thus, unroaſted in an *Aſſay-crucible*, and weigh to it four *Centners* of the *fluſs* made of *Salt petre*, and *Argol* (as before) with two *centners* of *flowing Glaſs-galls*, mingle all in the *crucible* and cover it (like a *copper-Oar*) with Salt, and ſet it in a little Oven, and boil it up alſo before the Bellows, and let it be cold, then you will find in the bottom of the *crucible* a *copper-ſtone*, then ſeparate it from the *ſlacks*, and weigh it, ſo you may ſee how many *centners* of the *flint* yields a *centner* of *copper-ſtone*. But if the *flint* be very rich in *copper-water*, then there will be no ſtone with the *fluſs*; therefore try the *flint* in another manner, *viz*. Weigh it raw, and put it in a *crucible*, mingle among it three times ſo much of clean good *ſlacks* (ſmooth ground) which yield no ſtone, nor contains any *Silver*, but come from poor Oar, cover it with *Salt*, and ſet it in, let it flow with ſtrong blowing: then you will find as much as the *flint* hath in it ſelf: But the *flints* that are rich in *copper-water* do yield a *ſlack-ſtone* which is not good to be melted, for in

in the roaſting, it will ſhrink too much and retain no *Silver* in it ſelf, by which many times hurt is cauſed. CHAP. IX.

CHAP. IX.

How to prove Copper Oar *another way.*

ALL *Copper-Oars* that are rich or poor in *copper* may be tryed upon *copper-ſtone*, after this manner, Take a pound of the Oar or Flint ſmall ground, and prepare a little *Oven* of *Tiles* ſquare or round of a ſpan wide, or let it be joyn'd with *Potters-clay*, bind it about with *iron-rings*, and lay below in it, Powder of Coals and Clay, (as in the Melt-ovens) with a hole on the back of the Oven, through which the *Bellows* may go; then put in your fire and Coals, and blow them well, that it may glow, and ſet the *raw Oar* which is ground, in it; yet not at once, blow continually ſtrong at it, that the *oar* may melt through the Coals down into the little *Oven*, and when it is enough, let it cool, and take it out of the *Oven*, and beat it, ſo you will ſee what it yields of *copper* or *copper ſtone*: if you finde in the *ſtones* either *copper* or *ſlacks* like *grains*, beat them ſmall, and draw it into *ſlicks*, then will the *copper* and *ſtone* ſeparate from the *ſlicks*. Section. 1.

This is a fine Tryal upon the *copper ſhiffer* and poor inſperſed *copper* Oars, but when the Oar doth not yield *ſtone* or *copper*, you will ſee it in the *ſlacks*, when they are not *coppery*, but all is turn'd to *ſlicks*. 2. *Copper Shiffer.*

Further, if you would have ſuch through-proofs of *copper*, and the flint yeild no *ſtone*, then firſt roaſt the *flint* quite dead, and melt it in the little Oven, and you 3. *When there will be no ſtone in the proof.*

Rrr will

CHAP. X. will finde a *Regulus* of *black copper*, or such as the *flint* or *copper Oars* do yield, which put together and weigh, and see what it hath yielded, so you may know how many *Centners* of *flinty copper* it yieldeth from a *Centner* of *copper*, for all roasted Oars work themselves *fresh*, and ☞ separate better than raw Oars.

4. But if one will try more than one or two pound in the little *Oven*, then one may *slick* it off from the *copper* with a little hot *Crucible*, and separate it from the *slacks*, *Another way.* but what remains in the little Oven together with the 5. *slacks*, which are not flown out, must be beaten and washed, and what is found shall be reckoned the Content.

6. Also in this wise one may melt raw *copper flint* unroasted in the little *Oven*, and drive it off, and see whether it give good *copper-stone* or raw *slack-stone*; also whether the *stone* in the *fire* be fixt or volatile: Only observe, that the little Oven must be first very well glowed, before it be melted in it, or else it will become all cold in the little *Oven*, and will not come together, as experience teacheth.

CHAP. X.

How to prove melted Copper-stone.

1. COPPER STONES are best prov'd like a *raw Copper-Oar* or *flint* (as hath been formerly shewn) *viz.* if one beat the same very small like *Hemp-seeds*, and then weigh it, and in a gentle fire upon a *Test*, let it be roasted, and put in the ground pieces, until it burns it self dead, and then let it be ground smaller, and mingle it with *fluss*, and a little *Glass-galls*, and cover it with Salt in the *Crucible* luted

ted in a little Oven, it will boyl like a raw Copper *Oar* or *flint* before the Bellows, and will settle it self to a *copper Grain* in the bottom of the Crucible, draw this up and weigh how much it contains, and make thy account upon it, how many Centners of *copper-stone* yields one Centner of black and unpurify'd *Copper*. CHAP. X.

Section. 2. There is another Tryal, *namely*, to weigh two Centners of Copper-stone, and mingle them with *Borax* and a little *Venetian Glass*, and let it flow upon a Proof *Test*, and blow with a hand *Bellows* until it appears green, so you will see how much the *Copper-stone* yields of *Copper*: and in this Proof the *Copper* will become clean and pure and most ready, and yield no black *Copper* (as in the Proofs above it doth.)

That you may see the form of the little *Ovens*, and how to make the *Copper-Proofs* in them, they are in the following *Sculpture*

Deciphered.

1. *The* melting Oven *to try the* Copper Oars *from the* copper-stone, *and the* Man *that blows the* Bellows.
2. *The luting it with* Clay.
3. *The* buck'd *and* vvash'd *Oar*.
4. *The little* Ovens *in which the* copper-Oars *are to be proved with ordinary* Bellovvs, *and the man that attends them.*
5. *The* Bellovvs *as they are used.*
6. *A* copper *Instrument with a neck in which water is put, and then set over the fire, and used in stead of Bellows (call'd the* Philosophical Bellovvs. *See* Sculpture II. Book I.
7. *The* Pot *in which the* Fluss *is to be made.*
8. *The* Assay Crucible.

Sculpture

Chap. XI.

Sculpture XXX.



CHAP. XI.

To prove Flinty Copper *by Sulphur.*

Section. 1. BECAUSE all *Flints* have *Sulphur* in them (yet some more than others,) if you will try them, and make a proof upon them, Weigh two *centners* of the *Flinty raw Oar*, and put it in a Proof-Test, and roast it dead (as I have mention'd

tion'd before off the *Copper-Oars)* let it be cold and weigh ſuch roaſted Oar again, now ſo much as theſe two *Centners* have loſt, ſo much they have had of *Sulphur*, for the *Sulphur* goes in the fire and in the air, this proof is eaſy, yet it is not manifeſted what *Sulphur* it doth yield, but that you may have the ſame *Sulphur* apparently; Beat the flint ſmall, to the bigneſs of an *Hazel* nut, put it in a great *Retort* made of the beſt *Potters-*Clay, that the *neck* of the *Retort* may hang in water, make a wood-fire about it, then the *Sulphur* will aſcend from the *flint*, and you will find moſt part before in the *Receiver* of the *Retort*, fine and yellow, but 'tis yet unwaſhed, and muſt be cleanſed in a ſtrong fire.

CHAP. IX.

Section. 2. *Retorts.*

3. How, this is further to be done, is to be ſeen in great *iron Retorts* when the *Sulphur* becomes *red.* But this is to inform the Reader, That all flints burnt in *iron Retorts* to *Sulphur* do yield *red Sulphur*, which Painters uſe to highten yellow or *orange* Colours, but the manner of making *Sulphur* with great *Retorts* do not appertain to this Treatiſe, therefore I have named it only for the Proof-ſake.

CHAP. XII.

How to prove Black Coppers *by* defty *or* ſmooth Coppers.

AS all Coppers come *black* out of the *Oars* upon melting, yet ſome much finer and cleaner than others, which muſt after be cleanſed and made ready; as they which contain no ſilver, and not purified, muſt be made ready and deft: Alſo to know certainly how many *Centners* of it after 1.

CHAP. XII.

Of Copper Needles.

cleanſing it yields of clean Copper (which muſt be proved in a little Fire.) Some think it may be known by ſpecial *copper Touch-Needles*, made on purpoſe: but becauſe the *black-Coppers* are not all alike, but ſome *iron-ſtreamy*, ſome *tinny*, *ſpizy* or *leady*, I cannot certainly determine concerning ſuch Proofs: But the beſt way is thus, Firſt, cut off from the caſt *Copper Ingot*, and weigh 2 or 3 *Centners* of it, and lute a *Teſt* with ſmall ground *leady Glaſs*, put the weigh'd *Copper* in it, and blow it in a freſh coal fire, till it hath a clean *green copper Colour*, then preſently, take the *Teſt* out of the Fire, and take the *Copper* out of the *ſlacks*, and quench it off, then cut it aſunder with a Chiſſel, and you will ſee whether it be good: then weigh and count how much the inſet *black Copper* hath yielded ready *Copper*.

2. *This Proof not certain.*

This proof, although the Copper be ſurer to be found, than by the *Touch-Needles*, yet 'tis not certain to ground upon; becauſe the Proof is ſmall and the Copper little, therefore very eaſily the Fire may take away ſomewhat too much if it be over-burnt, which in great Works cannot be done, and ſo ſomewhat more of red copper will be brought out.

If you will have the right proof, and know the right Content, the ſame muſt not be eſteemed too great a Labour, to make more than one Proof of the *black-Copper*, and then take the middle out of it.

You may uſe to this Proof, *Borax*, which cleanſeth the Metal much, and brings the copper to be ſooner ready: but, becauſe one cannot uſe *Borax* in the great Works, it were better this proof (eſpecially *iron-ſtreamy* Copper) might be helpt with a little clean *Lead*, becauſe 'tis uſed in cleanſing: and the copper will become *leady*, which doth much cleanſe the *Copper*, but if the copper be *leady*, then there needs no *lead* to be added.

3. *Another Manner.*

Some *Aſſayers* uſe this Method in their Proofs, *viz.*

They

They take a Teſt which is made moiſt,and make a little hearth in it of *Coal Powder,* mixt with clay, having a flat ſmooth hole cut out: upon this they ſet the copper which is to be proved, and blow it with the Addition of a little *Lead-glaſs,* this will the ſooner make it ready, but I think there is ſmall difference in what ever is driven off from it: but be ſure you drive not the copper too hard, and yet let it be of a right copper or *blick* colour.

Section. 4. Copper flint and Tin ſtone may be Seperated.

And, becauſe many times copper-flints are to be found, in which almoſt the half is *Tinn-ſtone,* and if copper be melted out of it, it would be very *tinny* and *ſpizy,* alſo if it were done among other coppers, all would be ſpoiled in the cleanſing. To prevent this, there is a particular way, *viz.* that by beating and waſhing one may ſeparate both Mettals by *bucking* or *cleanſing,* and then melt every part aſunder, and bring it to profit; of which way I ſhould write ſomething here, but becauſe I do not give a full Inſtruction in theſe my Books of the great Works (*viz.* of *Bucking, Waſhing* and *Smelting* Metal Oars) but only leſſer Works, therefore I will here end,till another more convenient time, when they may be further diſcourſed of.

CHAP. XIII.

CHAP. XIII.

How to prove whether Lead *be very* Copperiſh.

IF you think your *Lead* have much *Copper* with it, and would be aſſured thereof, Then weigh with the great weight a *Centner* of the *Lead,* put it upon a very flat Hearth, and make a ſmall fire of Wood upon it, lay alſo a green wood *A flat Hearth.*

before

CHAP. XIV. before, that the *Lead* may go and very gently pass away under the before laid wood: Now, when such *lead* hath copper in it, if only two pound in a *Centner*, so the copper will remain on the hearth, and what you find is but *leady* copper, but if you will have it very clean, then blow it with a *Bellows* upon a hearth, till it becomes ready, but in the little proof, 'tis seen upon the Coppel, for when the *Lead* which hath much, begins to go, then touch the Copper flowers, and the coppels will become black after 'tis gone off.

CHAP. XIV.

~~*Twelve necessary*~~ *profitable* Instructions *for an* Assayer *to follow.*

Section. 1.

FIRST, whether *Iron* doth become *Copper*? to which the Reader shall have this *Answer*, That I have a long while supposed, because the *Iron* in the *Coppery waters*, as in *Vitriol*, *green Argol*, and such like, do precipitate the *Copper*, that the *Copper* only is precipitated in such *iron water*, and not the *Iron* it self becomes *Copper*, yet I have seen in ☞ *Vitriol Mines*, (in a *Mine* called *Hesper*) when the *nails* and other *Iron Pins* fixt in the *copper-Oar*, by length of time have become a good *Copper* mearly by *Penetration*; therefore I must conclude, That the *Iron* doth become *Copper*; for though in the *Vitriol*, and other *copper waters*, the *Copper precipitateth* the *Iron*, yet there is not so much of it therein, as to turn it to *copper*: only know this, That while the *Iron* in such *Coppery* waters doth *precipitate* the *copper*, so the *copper* will precipitate the *Silver* (if it be in it) therefore 'tis fit, that to the common

mon precipitation of *Silver* in the *Aqua fort.* that the copper with *iron* pieces or *lamins* be put into the cleansing (as above is mentioned) with which the *Copper* and *silver* are precipitated, and what hath been in the *Aqua fort.* cometh out whole. CHAP. XV.

CHAP. XV.

Twelve Directions *how to separate* Silver *from* Copper *in the great Work.*

SO separate thus is a curious ART, which for many years the *Refiners* have kept as a great Secret, how the *Precipitations* are to be made right. But because the large Works are very great, therefore it could not remain secret, but is now known; yet there is still a difference, for in one *Furnace* it is better *refined*, and the prepared *copper* is made purer than in the other, also the Additions are not every where alike, and then many sorts of *coppers* cannot be refined all in one way, therefore for their sakes, who either know nothing, or but a little of such things, I will write somewhat as a tendency to that *Art.* Section. 1. 2. *One way of Preparation doth most serve for Copper.*

First, observe whether the *black Copper* be weak, deft, hard or brickle, for if they be weak and brickle before the refining, then the *Silver* will not come so soon out, but if one will give it its just due and heat, then the *copper* will flow under the *lead* through the *Oven*, and may cause hurt; therefore to the weak *Coppers*, there is no better way than to mingle other hard or *brickle copper* among it, that the one may hold the other. 3.

Secondly, one must be instructed how much the *Copper* holds in *Silver*, by a diligent Proof, for according to it, the *Copper* must be mingled with *lead*. And if 4.

CHAP. XV. the Contents be unequal as from 24 *Loths*, to 14, 8, or 10 *Loths*, then it muſt be made into a *Cake* by weight, near 27 pounds and an half of rich Copper, and 55 pound of poor Copper, upon this make your Account, how much *Silver* is in this 3 quarters of the *Centners* of Copper, and how much the *Lead* containeth which is to be uſed to the Addition, and then to every *Loth* of *Silver* which is in the *copper* and *lead*) 17 pound of *lead* is alſo to be counted ; and thus, of the refined *lead* (which is to be parted from the *copper*) a Centner will not contain above ſix and a half, or at the higheſt ſeven *Loths* of *Silver*. But if the refined *lead* ſhould contain more than 7 *loths*, it is a ſign that the Cakes remain too rich, and that the *ſilver* is not all come forth of the *copper*, and that there was not *lead* enough to the Addition.

Section. 5. *How much Lead to be uſed.*

6. But, that one may know how 'tis with the Additions upon every *Copper*, and what is to be obſerved in the refining *Furnace*, I ſhall demonſtrate it by Examples.

7. *A profitable Rule.* Take two *Centners* of *lead*, and three quarters of a *Centner* of *Copper* (of a rich and poor Content) either weak, hard or brickle, one among another, if therein is not 12 or 12 and an half *loths* of *Silver*, then take *lead* Oar or other *lead* to it which is *ſilvery*, that you may have the above mentioned *ſilver* in the *freſh* piece, and then add *Lead*, or *Littarge*, as much that there may come to four pieces, 8 *Centner* of *Lead*, and three *Centners* of Copper, and of this there will come out in parting 6 *Centners* of refined *lead*; every Centner of which contains 6 *Loths* and a half of *Silver*, the other *Silver* and *lead* will remain in the *cakes* and *lead*, which will almoſt all come to profit again, as you will hear hereafter.

8. Another Addition upon two and a quarter of a *centner* of *Lead*, *viz.* take three quarters of a *centner* of *copper*

per

per, and if there be not in it 15 or 16 *loths* of *Silver*, then take to it *rich lead*, which may enter in a fresh piece of such *Silver*: or, Take fresh and hard *lead* and *Litarge*, so that from 4 *Pieces* (upon an *Oven*) may come 9 *centners* of *Lead*, and 3 *centners* of copper, of this there will be 7 *centners* of refined *Lead*, of which a *centner* is to contain 6 *loths* and a half of *Silver*. CHAP. XV. Section.

9. Also, take two and three quarters of a *centner* of *Lead*, and three quarters of a *centner* of *copper*, and if there be not 18 or 19 *loths* of *Silver*, then take rich *lead* that it may reach the *Silver* and *Litarge*, and hard and fresh *lead*, so that (upon an *Oven*) in 4 fresh Pieces may come 11 centners of *lead*, and 3 *centners* of *copper*; and in dividing of this again, there will be 9 centners of fine *lead*, and one centner is to contain 6 *loths* and an half of *Silver*.

10. Or take three Centners of *Lead*, and three quarters of a *Centner* of Copper, if there be not therein 20 or 21 *loths* of *Silver*, then take *rich lead* which came in a *fresh* Piece of the *silver*, viz. from 4 Pieces (in one Oven) 12 *Centner* of *lead*, and three *Centner* of *Copper*, and when this shall be separated, then 10 *Centner* of pure *lead*; and one *Centner* will contain seven *loths* of *Silver* in the *Keinstocks* and *Thornells*, and there will remain 15 or 16 *loths* of *Silver*, and they are further to be wrought, as hereafter will follow.

11. But if there be very rich, or much other rich copper, and little of the light Contents, and that you cannot reach the right Addition, as above mentioned, then one must oft times add a rich fresh piece, *viz*. to three quarters of a *Centner* of rich copper add three Centner of *lead*, and so the separating Work will prove rich: and although the *Keinstocks* may also remain rich to 4, 6 or 7 *loths*: yet they may further be added to the rich Copper, and the fresh pieces be so right, that the re-

CHAP. XVI. refining *lead* may come out upon the true content, at six, or six and a half, or seven *loths* of *Silver*, at the highest.

Section. 12. But, if there are poor contenty *coppers* (not to be rekoned with the rich) yet you must do with them as before; but never take more than three quarters of a *Centner* of *Copper* to two or three quarters of a *centner* of *lead*, and if such *black copper* contains 8 loths, the *centner* of the separating work will contain two *loths* and an half of *Silver*: and the poor *separating lead* which comes from *poor fresh* may be added again to other *fresh pieces*, (as by the following Instructions may be seen) but there is no help for it, and, if possible, the poor fresh *lead* may be left alone.

CHAP. XVI.

Thirteen *additional* Instructions *about good* Copper.

1. *ITEM*, One piece shall have 2 *Centners* and an half of *Lead*, and three quarters of *Copper*, and there shall be no more in one piece than 18 *loths*.

2. *Item*, Three quarters of a *Centner* of fresh *Copper* to 21 *loths*, and three quarters of a *centner* of *Lead*: to three *loths* and a half, half a *centner*: to two *loths* three quarters of a *centner* of fresh *lead*, and a *centner* of *Litarge*: thus you have four Pieces of 77, and a half *loth* of *silver*, in 11 *centners*.

3. *Item*, Three quarters of a *centner* of *copper* to 18 *loths*, and an half *centner* of *lead*: to four *loths* and an half, three quarters of a *centner*: to three *loths*, one quarter of a *centner*: to two *loths*, one quarter of a cent-

centner of fresh, and one *centner* and 18 pounds of *Litarge*, mingled in 74 *loths* of *lead*, do yield 10 : and a quarter and an half of a *centner* of *lead*. CHAP. XVI. Section.

Item, Half a *centner* of *copper* to 15 *loths* of *Silver* content; and one quarter of a *centner* to 20 loths, and one *centner* of lead : To 4 Loths, half a *centner:* To two loths, one quarter of a *centner* of fresh : one *centner* of Litarge leaded in 70 loths of *Silver* doth yield 10 *centners* of lead. 4.

Item, Half a *centner* of *copper* to 15 loths: one quarter of a *centner* to 17 loths : one *centner* of *lead* to 5 loths: half a *centner* to one loth and an half ; one quarter of a *centner* fresh ; one *centner* of Litarge leaded in 70 loths will yield ten *centners* of good *lead*. 5.

Item, Three quarters of a Centner of Copper to 17 *loths:* one centner of *lead*, to 4 *Loths* : one dram, one quarter of a *Centner* to 4 *loths* and an half: one quarter of a *centner* to one *loth* and an half: and one quarter of a *centner* fresh, one *centner* and 18 pound of Litarge leaded in 74 loths yields 10 and an half *centners* of *lead*. 6.

Item, Three quarters of a *centner* of Copper to 18 loths and half a *centner* of *lead* : to three loths and an half, a quarter of a *centner* : to four loths and an half three quarters of a *centner* : to three loths one quarter of a *centner* : to two loths one quarter of a *centner* of fresh, and one *centner* of *Litarge leaded* in 76 loths and a half yields 10 *centner* of *lead*. 7.

Item, Three quarters of a *centner* of copper to 16 loths and half a *centner* of *lead:* to 3 loths and a half : three quarters of a *centner:* to four loths and an half: one quarter of a *centner* : to two loths one quarter of a centner of fresh: and one *centner* of *Litarge* (or instead of it, three quarters of a *centner* of fresh) leaded in 70 loths and a half do yield 10 *centners* of *lead*. 8.

Item, Half a *centner* of *copper* to 19 loths : and a 9.

 quarter

CHAP. XVI. quarter of a *centner* to 7 loths : one *centner* and a half of *lead* to three loths and a half : and half a *centner* to one loth and a half; and one *centner* of *Litarge* leaded in 69 *loths* and a half, yieldeth 10 *centners* of *lead*.

Section. 10. *Item*, Half a *centner* of *Copper* to 19 loths: one quarter of a *centner* to 16 loths : one *centner* of lead to 4 loths : one dram and half *centner* to one loth and a half: one quarter of a *centner* fresh, and one *centner* and 18 pounds of *Litarge* leaded in 74 *loths* do yield 10 *centners* and an half of *lead*.

11. If there be no *Litarge* to be had, then take half a *centner* of good copper to 9 loths, one quarter of a *centner* of *copper* to 30 loths: one *centner* and a quarter of *lead* to 4 *loths*, and an half *centner* to one loth and an half, and a quarter of a *centner* fresh : thus make all times the additions upon the hard lead, that there may be in a piece 10 *centners*, 10 and an half, or 11 *centners* of lead, also the *silver* in 4 pieces, 70, 72, 74, 75, 77 *loths*, thus the lead doth contain 7 *loths* of *silver*, happily one dram more or less.

12. *Item*, Three quarters of a *centner* of fresh copper to 20 *loths* : three quarters of a *centner* of *lead* to 4 *loths*; and half a *centner* to two loths, and one *centner* of *Litarge* : and half a *centner* of *fresh lead* leaded in 76 loths yields 10 *centners* of *lead*.

13. *Item*, Three quarters of a *centner* of *Copper* to 21 *loths* : three quarter of a *centner* of *lead* to three *loths* and an half ; and half a *centner* to two *loths* : and half a *centner* of *fresh* lead, and one *centner* of *litarge* , or three quarters of a *centner* of *fresh lead*, leaded in 77 loths and a half do yield 10 *centners* of *lead*.

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CHAP. XVII.

CHAP. XVII.

Six *additional* Instructions *about proving of fresh* Oar, *called* hard Lead.

ITEM, Three quarters of a *centner* of Copper to 11 *loths*; and half a *centner* of *fresh lead*; 2 *centner* of *Litarge* is leaded in 8 *centners*, into 4 pieces, contain 33 *loths*. Section. 1.

Item, A half *centner* of copper to 8 *loths*; a quarter of a *centner* to 15 *loths* : one *centner* and a quarter fresh, is leaded in 8 *centners*, into 4 pieces contain 31 *loths*. 2.

Item, Half a *centner* of copper to 15 *loths*; one quarter of a *centner* to six *loths*, three quarters of a *centner* to two *centners* of *Litarge leaded* into 9 *centners*, into 4 pieces, contain 36 *loths*. 3.

Item, Three quarters of a *centner* of copper to 11 *loths* and a half, and half a *centner* of *fresh*; and two *centners* of *Littarge leaded in* 8 *centners*, into 4 pieces, and *contain* 34 *loths* and a half. 4.

Item, Half a *centner* of copper to 13 *loths*: a quarter of a *centner* to 10 *loths*: half a *centner* of *fresh*, two *centners* of *Litarge* leaded in 7 *centners*, into 4 pieces, contain 36 *loths*. 5.

Take notice, if the Copper be very poor, then you may add such *lead*, as doth contain one and a half, or 2 *loths* of *silver*. 6.

CHAP.

CHAP. XVIII.

Three Additions *concerning* Thornels, *or parts of* Oars *not fully melted.*

Section. 1. TAKE two *Centners* and an half of *Thornells*, that is half *separated* Oars, and half *roasted*, and a *centner* and a quarter of *hard Lead:* and a quarter of a *centner* of *Litarge*, the *Lead* must contain 3 and a half: 4 *loths*, 4 and a half, till to 5 *loths*.

2. *Item*, to a *Centner* of *Littarge* is counted 3 quarters of *Lead* ; and a *Centner* of *Littarge* is counted at 135 pounds ; and also upon 145 pounds of *hard Lead*, one *centner* of soft *Lead*, although to some separating Works are taken 130 pound of *Litarge* in stead of a *centner* of *Lead*, and 140 pound, hard Lead, instead of *soft lead.*

3. Also there goes commonly off from 10 *centners* one *centner* and a half of *Lead*; thus you may know how to substract from the additions together with the *Loths*, which will be found in the *centner*.

CHAP. XIX.

Six *more* Instructions *concerning* good *and* deft Coppers.

1. ITEM, Take *Copper* to 11, 12, 13, 14, 15, 16, *Loths*, and of this one may make hard Lead, being commonly taken as Additions: of which 65 pounds will yield at all times in 4 pieces 39 *loths* of *Silver*; but if it be not enough

enough (with the 65 pound of *Copper* in the Content) then one may take of the Copper three quarters of a *Centner*, and at all times upon one loth of *Silver* 29 pounds of *lead*, and this will make in one piece, three *Centners* four pounds of fresh *lead*, and in four pieces, 12 *Centners*, and 16 pounds, in which are 42 *loths* of *Silver*. Chap. XIX.

Section. 2. *Item*, 65 pounds of *Copper* to 15 *loths*: one *centner* and a quarter of a *centner* of fresh *lead*, and 305 pounds of *Litarge*, there will come upon 4 pieces 11 *centners* 31 pounds of *lead*, in which will be 39 *loths* of *Silver*; and if one doth sever it in an Oven, and with such Additions, there will come out of it 9 centners of *lead*, which will contain to three and three quarters of a *loth*, or three *loths* and a half: this is together, 33 *loths*, three drams; so there will remain in the *Thornels* and *Keinstocks* five *loths* (if well wrought) but it consumes much *lead* by it.

3. If the Copper contain 18, 19 or 20 *loths*, 'tis usual to take sixty or sixty five pounds of Copper, according as one hath poor or rich *lead*, and the Addition is made thus, that together in 4 pieces, may come 75 *loths* of Copper and lead; and upon this 75 *loths*, is taken one *loth* and 15 pounds of *lead*; if then one do sever it in an Assay-*Oven*, it will yield 9 *centners* and an half of *lead*; and this will contain 6 *loths* and a half, or six *loths* three drams, and then there will remain in *Thornells* and *Keinstocks*, 11, 12 or 13 *loths*, but how the Additions are to be made, is hereafter specified.

4. *Item*, One piece shall have (with *lead* and *copper*,) 3 Centners, 25 pounds, and four pieces; together 13 Centners, and of *lead* 11 Centners, 25 pounds, so there will come in one piece 65 pounds of Copper, to 17 *loths*; and two Centners and a half of *lead* to three

Chap. XX. *loths*; yet the 4 pieces will contain no more in *copper* and *lead*, then 75 *loths*.

Section. 5. *Item*, 65 pounds of Copper to 18 *Loths*, make 47 *Loths* addition in the *Lead*. Take one *centner* three quarters of *Lead* to 4 *loths*, they do bring in 4 pieces; 28 *loths* one quarter of fresh, and 30 pounds of hard, so there will come 11 *Centners*, 25 pounds of *lead*, in 75 *loths*.

6. But the *Thornels* which are to be severed from it, must have this Addition, Take to one piece, one *centner* and a half of *lead-Thornels*, 1 *Centner* of roast *Thornels*, 1 *centner* 18 pounds of hard, and one quarter of a *centner* of fresh *Lead*, and 30 pounds of *Litarge*, then the *lead* will commonly contain 3, or 3 and a half, to 4 *loths* of *silver*.

CHAP. XX.

Seven more *additional* Instructions *about good* Copper.

ITEM, if one take to a piece of 80 pounds of Copper, which may contain
1. 15, 16, 17, 18 or 19 *loths*, and so there will be of 4 pieces, ten *Centners* of *lead*, and so in one piece, 2 *Centners* and an half, the process is thus, Take one *Centner* of *Litarge*, one *centner* and a quarter of *lead*, to 4 *loths*, one quarter of *hard lead*, and a quarter of *fresh lead*, as it happens, yet that in 4 pieces will come to no more than 72 *loths* of *Silver*, and take to one *loth* 14 pound of *lead*, and this in one piece will be two *Centners* and a half, and 2 pounds of *lead*, yet 'tis always better to take much *Litarge* and little *lead*, for the *Litarge* doth draw better to it self the *Copper* than the fresh *lead*, likewise much *Copper* than little, and so the *lead* will not consume

consume so much, and there will be wrought much more *copper* with less *lead*. Therefore if you take 65 pounds of *copper* to one piece, then there will be to four pieces, eleven and a quarter of a *centner* of *lead*, and one melting may make just so many pieces. But if you do take 80 pounds of *copper*, for 65 pounds of *lead*, then there will remain in the *Thornels* and *Keinstocks*, 10, 11, or 12 *loths*. CHAP. XX.

Item, Take 75 pounds of Copper (rich or poor) and in four pieces 72 *loths*, that upon one *loth* may come 14 pounds of *lead* into four pieces, 10 Centners, 8 pounds of *lead*, and this doth yield commonly good *Keinstocks*, and if this be thus severed, then the *lead* of it will contain 7 *loths* of *Silver*, and a dram more or less. Section. 2.

Item, to make *hard lead*, take 65 pounds of *Copper* to 19 *loths*, and 200 pounds of *Litarge*, and 190 pounds of *hard lead*, and 40 pounds of *fresh lead*, to two *loths*; and thus there will be in 4 pieces 52 *loths*, and one dram, and ten *Centners*, and 80 pounds of *lead*. 3.

Item, take 75 pounds of Copper to 16 *loths*, and not more than 48 *loths* in 4 *pieces*, and to one *loth* 21 pounds of *lead*, that the most part may be *Litarge*, so the *lead* will contain 4 *loths* and a half, or 5, and remain in the *Keinstocks* 6 or 7 *loths*. 4.

In brief, to *fresh Copper* one may take three quarters of a *centner* of *Copper*, and two *Centners* and an half of *lead*, and in four pieces not above 34 *loths*, this doth well; and to the *hard lead*, three quarters of a *Centner* of copper, two and a quarter of a *centner* of *lead*, and no more, and it will bring into it 33, 34, to 38 *loths* of *Silver*. 5. *Fresh Copper.*

Concerning the poor coppers (they are partly severed in *Hungary*, and contain to five, six, seven, eight loths of *Silver*, or nine at the highest) they must be so severed 6. *Hungarian Copper.*

CHAP. XX. severed, that the severed *lead* may come upon the right Content, as a centner upon six to seven *loths* of *Silver*, so the copper will be good, and if you add *lead* according to the Content, the copper will not have *lead* enough, and the *Silver* will not come all out, and the *Keinstocks* will remain rich.

Section. 7. Now, when the *Melter* makes the *fresh Pieces*, then must all their Additions first be weighed upon every piece apart, and then he must put the *Copper* and *hard lead* first in, and afterwards the *Litarge*; and lastly, the *lead* in the *Oven*, and when the Division of one part is almost gone down, put after it a quantity of *slacks*, that when he seeth the same, he may know how much hath been weighed (in one piece) out of the *Oven*, before he put in the other, and when that goes down in the *Oven*, pour the first piece out of the furthermost *Crucible* into the pan, and then take care that one piece may not be heavier than the other, and so he must still labour till he hath cast all the pieces (as such practise will shew) But how the *fresh Oven* is formed, and the *fresh pieces* cast, you may see in the *Sculpture* following, thus

Deciphered.

1. Copper *and* Lead *in pieces, weighed.*
2. *The* Oven *for Assaying those piecs of* fresh Oar.
3. *The* Copper-pan *into which those* fresh pieces *are to be put and melted.*
4. *The* fresh piece *melted.*
5. *The Melter.*
6. *The* Vault *in which the Dust and Smoak is received.*
7. *The little* door *out of which the* dust *is to be cleansed.*

Sculpture.

Sculpture XXXI.

CHAP. XX.



CHAP. XXI.

Nine Rules, *shewing how the* Regulus *of poor black* Copper-Oar *is to be* assayed, *after the* Hungarian *Method.*

Section. 1.

FIRST, I will mention how the *poor Coppers* are to be split before their melting in the separating Works, and the content made rich, that they may the better be *melted* and separated.

2. *The Melting Oven for them.* *Item,* in the *Sheds* or *Houses* where *black Coppers* (which commonly contain 5,6, or 7 *loths* of *Silver*) are used to be smelted there, the melting Oven for them is formed like a driving harth with a *Vault*, and in the fore-part thereof the fire is to be made of *Birch*, or other small split fire-wood (as is used in *Kitchins*) and the melting *oven* must have a *Crucible* before it, in which the *black Copper* (when 'tis wrought enough and becomes good *Copper*) may run out of it: On the other place of the *Oven* are the *slacks* done off, and the Bellows are not to blow in the midst of the *Oven*, but on an *iron Pipe*, which is directed against a corner of the Oven, in which the *Wind* may blow, so that it may go through the *Pipe* into the *spleiss Oven* in the midst of it upon the copper.

3. If you will smelt them, then put into the smelting Oven 38 *centners* of black copper, of which the *centner* contains six *loths* of *Silver*) when this is smelted, let the slacks go off from it; that it may be 11 to 12 *centners*, then 4 to 4 *centners* and an half, in which you must be diligent, that you may know how to give it its due heat. After open the smelting Oven near the foremost *Crucibles*, and set

ſet the copper in it,and ſmelt of the 38 *centners* of black copper, out of the Crucibles 18 to 19 *centners* of good and rich copper,but of the ſmelted Copper, every Cake is to be cut out, and caſt into Ingots, of which a *centner* holds commonly near 9 *loths* of *Silver*, the remaining *Silver* you will have in what is ſwept off, and in the *ſlacks*, as follows. CHAP. XXI. Section.

4. But becauſe much ſmelting at once(as in great works) is counted by the *Smelters* a Work for half a week, therefore to this belongs a Maſter and a Servant, and they cannot work but twice a week in an Oven, and to ſuch Operating in one work; there is to be uſed near 4 layes of Wood.

5. *Red Copper Regulus.* The *ſlacks* that come from the above-mentioned black *Regulus*, or which are twice done from the copper, muſt be beaten ſmall as *Wallnuts*,and ſmelted through a ſmelting Oven, then draw the *ſlacks* off again from it in the *crucible*, and out of it you will have a *red Regulus*.

6. Of this red *Regulus*, one muſt take 40 *centners* for a *ſmeltingOven* (as above is ſignified) and may ſmelt of it 30 to 31 *centners* of red *Copper*, and of this the *centner* contains two and a half, to 3 *loths* of *Silver*, which cannot all be brought out, therefore it muſt be forced out with an *hammer*. But if it be made to ſell for Bells, then there muſt be ſmelted of this 40 *centners*, or 33 *centners* to 35 *centners* of red *Copper*, and to this one needs but one *Oven*, 2 to 2, and half the proportion of wood, and 'tis counted by the *Smelters* for two Works for a Week, as upon the *black Coppers*.

7. But the *ſlacks* which (of this 20 *centners* of *Regulus*) are to be done off out of the ſmelting *Oven* (and happily 6, 7 *centners* to 7 *centners* and an half) they are to be beaten aſunder and ſmelted through a ſmelting *Oven*,and one may draw off the *ſlacks* in the *Crucible*,and make of a *Cobolt Regulus*,or *Copper-ſtone*,40 *centners* upon a ſmelting *Cobolt Regulus.*

CHAP. XXII. ting *Oven*, and ſmelt it off from 32 to 34 *centners* of *Licbeter* or ſpeizy or unclean *Copper*, of which a *centner* contains one, or one and an half *loth* of *Silver*.

Licbeter or ſpizy Copper.

8. Now when all is ſmelted off,then take that which remains upon the *brim* of the driving harth,alſo that which is about the *crucible*, and ſome good *ſlacks*,and beat them ſmall with the *ſtamp*, upon which the water doth run, and then the good *copper* will fall on the ground,and that is to be gathered and waſhed and then ſettled: and, if it be at hand put 12 to 14 *centners* upon the *ſmelting Oven*. Likewiſe happily 5 or 6 *centners* of *leady-Copper* which remain'd upon the *harth*; and if the *copper* enters in it,and will not out again,then put to it 18 *centners* of black *Regulus*: and ſmelt again 20 *centners* of ſtampt *Copper* (which *Copper* is to contain 12 to 13 *loths*) and this ſame, being thus aſſayed, one may ſet it upon the *driving* harth, and drive it off with the poor and rich *lead*.

ſtampt Copper.

What comes off at laſt from the ſtamps in the *caſting* and ſettlings,is alſo to be taken up, for 4 *centners* of this will yield a *centner* of *copper*, and ſuch is to be ſmelted with the *ſlacks*.

CHAP. XXII.

Seven *more* Inſtructions *for the* Hungarian *way of* ſeparating, *and how the firſt work or* Inſtrick *is to be performed.*

TO the firſt *Inſtrick* (by which you muſt underſtand the firſt *Schicht*, work or operation which a Maſter with his Servant can ſmelt in 8 or 9 hours)they do take 30 *centners* of rich or good *Copper* and freſh *lead*, which comes from *Craccaw*,

caw, of which a *centner* contains near one loth of *Silver*) 110 *centners* : in all 140 *centners* of Copper and *lead*: out of which work will come 40 pieces, this being put out of the former *Crucible* into a copper pan, there will come upon one piece of rich and good Copper, three quarters of a *centner* ; of *fresh lead*, two and three quarters of a *centner* : And every Smelter must observe, That the Addition of every *piece* come only to one piece, and that the piece may be cast equal, that to the whole work may not come more or less pieces than were weighed to it before (as above is signified) the *flacks* are afterwards to be drawn clean off, out of the foremost *Crucible*, and smelted again in the *Oven*, and out of this will come *flack-lead*, and the *centner* will contain one *loth*.

CHAP. XXII

But the above-said 40 pieces are to be assay'd so that alwayes five pieces be set upon the *Assay*-Oven, and the *lead* which flows out of it (being in a hole) is afterwards to be cast into little *copper* pans, and the *Centner* of the same *lead*(according as the copper is rich)will commonly contain 2, to 2 *loths* and a half of *Silver*; and that which remains upon the *Assay*-Oven is called *Keinstocks* (which are pieces yet undry'd or unroasted, and what falleth down from the *Assay*-Oven, and between the *roast*-Oven are called *Thornels*, of which *Thornels* they do weigh 80 or near 100 pounds. Section. 2. *Keinstocks.*

These *Thornels* are thus to be made to profit ; Take 20 *Centners* of them from the *Assay*-Oven, and 20 *centners* from the *roast*-Oven, and 40 *centners* of hard *lead*, and *Litarge*, of each sort half; (in the whole 8 *Centners*) out of this there will come from the Work 20 pieces : and there will come upon one piece 2 *Centners* of *Thornels*, and 2 *centners* of *hard lead* and *Litarge*, for it must be thus distributed upon the *pieces*, and the *flacks* upon the foremost *Crucible* must be drawn off clear 3. *Thornells.*

CHAP. XXII clear, these are to be smelted apart, and out thereof will come the *flacks* of *lead*.

Section. 4. *The first Inlay.* Afterwards 5 pieces of these 20 pieces of *Thornels* are alwayes to be set upon an *Assay*-Oven, and assay the *lead* of it, of which a *centner* will contain near 2 loths of *Silver*, and the *Keinstocks* will remain above, and what falleth down betwixt the *Oven* is (called, as is said, *Thornels*) and they do weigh near 8 pounds, as above is mentioned.

5. *The second Inlay.* To the *second Inlay*, by which you must understand the second Work) the Additions are to be made thus, they do take rich or good broken *Copper*, 20 *centners* and 20 *centners* of *Thornels* from the separating and roast *Oven*, one with another, and 20 *centners* of *Litarge*, (in the whole 60 *centners*) out of this comes 40 pieces, so there is to each piece half a *centner* of good *Copper*, and half a *centner* of *Thornels*, and half a *centner* of *Litarge*, and these are to be set (as before) always 5 pieces upon a separating Oven, and assay'd, and the *Lead* of it is to be cast into little *copper pans*, and the *centner* will contain 3 and a quarter, to 3 loths and a half of *Silver*, and the *Keinstocks* will remain in the separating Oven, and the *Thornels* fall down: Now, this is not used in the common work, but only when rich *Copper* is to be taken to the work, or the store doth increase.

6. *The Third Inlay upon rich Copper.* To the third Work you must understand the third measure, which is called *Rich putting in:* the Additions are to be made thus, Take 30 *Centners* of rich and good Copper, and of the *Thornels* of Lead, 120 centners (in the whole 150. *centners*) then smelt all through the Oven, and draw the *flacks* clean off, and of these will come 40 pieces, and of one piece will come three quarters of a *Centner* of *Copper*, and three *Centners* of *Lead*, and these 40 pieces are to be assayed, and every time set 5 pieces on a separating Oven, and the Centner of this

lead

lead will contain near 3, and three and a half *loths*, and of this there will also come *Keinstocks* and *Thornels* like as of the second Work. Chap. XXIII. Section, 7.

But to this third Work or Inlay, To one piece is to be taken a quarter of a *Centner* more of *lead* than to the first; the reason is, because to the first there hath been added *Crackaw* lead, which hath contained *Silver*: secondly, because it is Copper: and thirdly, That so the rich works in the *lead* (which in the working are become Coppery) may also be included.

CHAP. XXIII.

How Litarge Pieces *are to be made.*

LITARGE Pieces are to be made thus, First, their addition is upon a *Shich*, to 15 *centners* of rich copper add 15 *Centners* of *Thornels* from the *Assay*-Oven, 60 *Centners* of *Litarge*, and 37 *centners* and a half of *slacks* or fresh *Lead*, (in the whole 127 *centners* and an half: This stuff may be smelted in the Oven by a Master and his servant in 8 hours, and the *slacks* being clean drawn off, and then being cast into a pan, it makes 30 pieces; and in one piece, will be half a *centner* of rich *Copper*, and half a *centner* of *Thornels* from the *Assay* Oven, 2 *centners* of *Litarge*, one *centner* and a quarter of *slacks*, or fresh *Lead*. 1.

These mention'd 30 pieces of *Litarge* are to be assayed, and alwayes 5 pieces to be set upon the *Assay*-Oven, and out of this will come the *lead* which is called *Litarge-lead*, and one *Centner* will contain 2, to 2 and a dram of *Silver*, and there will come also out of the *Assay*-Oven *Keinstocks*, and *Thornels*, as in the second Assay-work. 2. *Litharge.*

Another

Chap. XXIII. Section. 3. Another *Addition* upon *Litarge* pieces is this, They take 15 *centners* of *copper*, 15 *centners* of *Thornels* (from the *Assay* Oven) 90 *centners* of *Litarge*, 15 *centners* of *flacks* or fresh *lead* (the whole 135 *centners*) and out of this will come 30 pieces, and to one piece will come half a *centner* of rich *Copper*, and half a *centner* of *Thornels* from the *Assay*-Oven, and three *Centners* of *Litarge*, and half a *Centner* of *flacks* or fresh *lead*.

4. The before-mentioned 30 *Litarge* pieces are to be *assayed*, and set 5 pieces at once upon an *Assay* Oven, and the *Centner* of lead which comes of it will contain two to two *loths* and a quarter of a *loth* of *Silver*: of this also there is *Keinstocks* and *Thornels*, as formerly hath been mentioned.

5. *The last Inlay.* When all the before-written *assayed* rich and poor *lead* are brought together, they make this account upon it (whereby they may know to make an *Inlay*, (that is a quantity of it) so that a *centner* in the same *Inlay* of rich Copper and lead in the *assay'd lead* may contain 5 *loths* and a quarter of a *loth* of *Silver*, and this *Inlay* is to be made thus. Take 26 *centners* and a half of rich copper, and 115 centners and a half of rich and poor *lead* (that they may come upon the before-mentioned reckoning) so that a centner may contain 5 and a quarter, or at most 5 loths and an half of *Silver*; what is done above, is with dammage, and the ready *copper* will become too rich: In short, 141 *centners* and three quarters of a *centner*, are also to be smelted through an *Oven*, and the *flacks* drawn clean off upon the foremost *Crucible*, and a Master and servant to make this *shich* or work into 42 pieces, so there will be to one piece 5 eight parts of a *centner* of the rich Copper, and of all the sorts of rich and poor *lead*, 2 and three quarters of a *centner*.

6. These now mentioned 42 pieces they assay upon an *Assay*-Oven, but no more at once than 5 pieces of rich

rich lead, that one centner with the other may contain Chap. XXIV.
5 *loths* and a quarter of *Silver*, and there will remain alſo upon the Oven *Keinſtocks* and *Thornels*, which are fallen down,ſuch Thornels which come of rich *lead* they ſeparate, for they are the beſt, and are to be uſed again, and to be laid among the *Litarge*-pieces: Upon this poor Contenty Copper Aſſaying, meditate with diligence, for 'tis a profitable Inſtruction.

CHAP. XXIV.

How Silver *is to be ſeparated from ſpizy and unclean* black Coppers.

WHEN the *ſpeizy* and very unclean *Silver* Contenty *coppers* are to be ſeparated from other good *coppers*, then they uſe the *prepared coppers*, which are deft of themſelves, though they are brickle and unſmooth,and are not to be uſed to all ſorts of Works: to avoid this, prepare to aſſay ſuch degenerate *black coppers* as follows: Take ſuch *black Coppers*,and dreſs them like a black *Licbeter Copper* with help of the *lead*, by theſe means they will become clean and deft, and brought thus into compaſs, ſo that oftentimes of three *centners* hardly remains one, yet nothing of the *Silver* gone off, but what hath been before in the three raw *centners*, and this is to be found together, and then ſeparate this prepared *copper*, with good *copper*, or by it ſelf (as is uſual) and in *Hungary* they uſe this care about the poor *Coppers*, though not very unclean, which in their ſeparating is often try'd, and the *coppers* becomes rich by it.

But that you may ſee how the *copper* Ovens are

CHAP. XXIV. formed, and how to assay upon them, this following *Sculpture* will shew.

Sculpture XXXII.



Deciphered.

1. *The* separating Oven *as it stands* fram'd.
2. *The* Supporters *to it made of* Copper, *as they are to stand under the* Oven.
3. *The cast pieces as they are to stand in the* Oven.
4. *The* Walls *of the* Oven *(or the four sides of it) and the fire in it, and how the* Oven *is brac'd with* iron hoops.
5. *The stamp'd Pieces, and coals on the top of the* Oven.

6. *The*

6. *The copper or iron little pans, with a man putting the melted stuff into them.* Chap. XXV.
7. *The Keinstocks.*
8. *The* Crane *or draught by which the assayed pieces are to be lifted out of the assay-Oven, or otherwise dispo-sed of.*
9. *Instruments,* viz. *Ladle, Picker, Fork and Hook.*
10. *The troughs or place to cool the Instruments in water.*

CHAP. XXV.

Instructions *for* driving Lead *and* Copper *from* Silver.

IF you have enough of that rich *Lead*, of which a *centner* contains 5 *loths* and a quarter of *Silver*, then prepare the driving harth, formed with a Vault like a great Bakers Oven, and lute it with all diligence, and lay 100 *Centners* of this *lead* upon it, and six *centners* of the richest copper, which is to be pick'd out of the harth of the *speize Oven*, of which the Centner contains 10 to 13 *loths* of *Silver*, (which is call'd the stamp'd *Copper*,) drive the work, but not quite off, and if it make *lead flacks*, then quench it and retain the same *lead flacks*, so in this will be near 50 marks of *Hungarian* Silver.

Two drive harths. But there must be two driving-harths one near the other, and while you drive off the one work, the other must be prepared with diligence for the other, and then put upon it six *centners* of the richest *Copper*, and an hundred *Centners* of rich *Lead*, which contains 5 *loths* and a quarter of *Silver*, and drive off the work (as aforesaid) and when the *Silver* will almost go to it, then add the said *lead flacks* in which the 50 marks of *Silver* are

CHAP. XXVI. are, and let the work go quite off, thus you have 100 *marks* of *Silver* to 15 *loths* of fine. But ſuch works are uſed to drive them off in 4 or five weeks, that commonly one week with another, is reckoned to make 125 marks of *Silver*, and 'tis needful to ſuch a driving off, to have 4 layes of wood, and you muſt not feed the fire upon ſuch driving harths with long *ſplit-wood*, but (becauſe the Oven hath a ſingular Vault) it muſt be fed with good dry *faggot-wood*, and let the *Bellows* go true upon the work.

CHAP. XXVI.

Of driving the Keinſtocks *and* Thornels.

Section. 1. KEINSTOCKS are prepared upon the ſaid *Aſſay-Oven*; and if it be of rich or poor *Lead*, or *Thornels* or *Litarge* pieces, put them together in a *driving Oven*, and let there be four ſuch *driving Ovens*, and in every one 4 *Rows* or *lanes*: upon theſe you are to ſet all ſorts of *Keinſtocks*, near 120 *centners*, then make a *fire* of dry *ſplit wood* before and behind the Rows of *Litarge*, and dry the *Keinſtocks* about 12 or 14 hours, and that which runs firſt out into the *Litarge* rows (which will be but little) this pour out, and it is freſh *Lead*, and what remains of the *Thornels* will fall down in the rows, then they are to be melted to *thornels*, like thoſe which are flowen out under the *melting Oven*.

2. *Item*, ſuch *Keinſtocks* which remain above thoſe Ovens, are not to be boiled in the great *ſpeize* Ovens (like the raw black *Coppers*) but muſt be beaten and knock'd that the *ſhiffer* and other uncleanneſs of them may be removed

moved, and then put them upon the *boyling harth*, and drive the copper to be pure, and when the *ſlacks* are clean drawn off, then ſplit the *plates* or *cakes* one after another, this is ready and deft copper, and ſo the remains that are in a *centner* of ſuch ready copper will be almoſt a loth of *Silver*, and one doth take to a *ſhich* 4 harths to contain near 18 *centners*; there are to be two ſuch harths or copper-ovens in the ſeparating houſes or ſheds, wherein you may ſpleize or work all working dayes. Chap. XXVI.

Section. 3. *Copper Regulus.*

The *ſlacks* which are to be drawn off from the harths are to be melted again through a melt Oven, and a *Regulus* made of them, which is called a *copper Regulus*, which I judge to be like the Copper, made at *Swatk*, ſet them in a dry Oven and dry them off, from this the *thornels* will fall down into the *rows*, theſe muſt be melted into *thornels*, (as above is mentioned) for ſuch copper *Regulus* muſt not be wrought by it ſelf, for they are *ſpeizy*, therefore you muſt mingle them among the *Keinſtocks*, which are to be dryed, and you may make pure copper of them.

Thus you have ſufficient Directions how *Coppers* may be aſſayed and ſeparated. 4.

But concerning the reckoning which (alwayes in ſuch things) is neceſſary to be made known, I will not recite here, for every ones Practice will teach them, and the keeping of the Book is the ſureſt Rule for it. The next *Sculpture* is thus 5.

Deciphered.

1. *A* drying Oven.
2. *An* Oven *ſoon made according to the* Hungarian *way.*
3. *A common and ready* Harth *for* drying.
4. Keinſtocks, *as they are to be pick'd and beaten by a man.*
5. Harths *for the* Hungarian *ſpeizing or working.*

CHAP. XXVI.

6. Copper Cake, *quench'd in a Ciſtern of Water by a man*, 6. 6. 6.
7. *A* Pipe *and* Tub *that lets water into the* Ciſtern.

Sculpture XXXIII.



CHAP.

CHAP. XXVII.

A singular way of melting *in the Assaying* work.

WHEN flint or Copper *Oars* are intended for *Copper*, then the Oars are to be roast-ed well and stick'd through; and then to make it *Copper* it must be burnt and roasted again. Section. 1.

In such work one may surely know the Content of the *raw stone*, and also by the Content of the Stone (which is *stick'd* through the little Proof) how much *Copper* and *Silver* is in it.

When the stone for making of *Copper* is perfectly pre-pared and burned; then take of this roasted Common proof (among some other) and prove it by 2 or 3 proofs upon *Copper*, and then the *Copper* upon *Silver*, and when the *Copper-stone* in the roast is of unequal content, it is not well mingled, yet you will find in the content, a very small difference; yea sometimes none at all, and then see whether the content of *Copper* (of the roast) doth agree with the content before, which is found in the through burnt stone.

Therefore try whether you have all the *Silver* in the *roast* which was in the *Copper*-stone, if there be a diffe- 2. *Copperroast.* rence to 3 or 4 loths in a *Centner* against the other, then take the middle of it, and make your Additions thus, In case you have found in a prepared roast (through the little proof) that two *centners* contains three quarters of a *centner* of *Copper*, and a *centner* of this *Copper* contains twenty loths of *silver*. Then weigh of 3. *Addition of parts.* that which is melted 2 *centners* of the roast, and set them asunder, one *heap* after another, and of eve-

ry

CHAP. XXVII. ry *heap* two *centners* of roaſt, and to every part weigh its due of *Lead*, that may alwayes come upon a *loth* of *Silver*, (which is in the *Copper* 18 *loths* of *lead*) or if it be good, 17 pound: and are to be weighed to the roaſt-*heap* which is weighed off, and becauſe two *centners* of the *roaſt* do contain three quarters of a *Centner* of copper, (and muſt be melted through, to one *piece*) then after the common proof, three quarters of a *centner* of *Copper* will contain 15 *loths* of *Silver*; then weigh to it 15 times 17 pounds of *lead*, ſo upon every *freſh piece* will come two *centners* 35 pounds of *lead*, and one *freſh piece* will weigh 3 *centners* 7 pounds.

But 'tis to be obſerved (in making the Addition of the *lead*) that you muſt know what the *lead* contains, *viz.* whether the *centner* had 1 or 2 *loths* of *Silver*. Then upon the ſame *Silver* which the *lead* contains upon every *loth* muſt be counted 17 pound of *lead*; for the *Aſſay*-work muſt contain but 7 *loths*, if they contain more, 'tis a ſign the *Keinſtocks* is too rich, and the *Silver* comes not all out of the Copper (as is before mentioned) therefore if one hath *lead* which contains *ſilver*, ſuch cannot be taken to the rich Coppers, for the freſh pieces are too great and receive too much *lead*, and the Copper will go through the *Aſſay*-Oven with the *lead* to loſs.

Section. 4. *Addition of parts.* But if one have *copper-ſtone* or *poor copper* which may yield to 10 or 12 *loths*, to this it may be uſed; eſpecially if it becomes good, then the Addition muſt be thus: If you find by the Proof, That 2 *centners* of the *roaſt-ſtone* contains three quarters of a *centner*, and one *centner* of the *Copper* 12 *loths* of *Silver*: then in 3 quarters of *Copper*, or in two *centners* of *roaſt-ſtone* there will be nine *loths* of *Silver*; to this add the due of *lead*, upon every *loth* of *Silver*, 17 pound; and becauſe one hath not other *lead* than what the *centner* contains in 2 *loths* of *Silver*,

then

then there will come upon the 9 *loths* of *silver*, in the copper, and of the *silver* in the *lead* to one piece, 2 *centners* and 1 pound of the two *loths* of lead: but to a fresh piece you must not take all such weak lead, or which doth contain *silver*, but mingle it with the fresh *lead* that the *silver* may come out cleaner, yet for want of fresh *lead*, somtimes such weak lead is taken as necessity requires. CHAP. XXVII.

Upon the common melting Furnaces, the Additions are made in stead of the fresh *lead*: with hard *lead* or *Litarge*, and substract the waste, what might go off in the *fresh*, and in stead of the 100 pound *fresh lead* you must take 125 pound *hard lead* and *Litarge*; yet the *Litarge* and hard *lead* must be refreshed with *fresh lead*, else, at the last when the hard *lead* is too weak, there will be damage: This may be used also in this labour and melting, if one have *Litarge* and *hard lead* that (according as above is mentioned) to add to the 2 *centners* of roast the competent weight of *hard lead* and *Litarge*, and let it go through the *Oven*, and then the fresh pieces are cast right. 5. *Hard oar and Litarge*

But possibly some person may say, It could not well be done for the *spar-stones* sake; yet it must again be considered, Though the *spar-stones* may be *leady* yet they will be very poor in *silver*, and therefore they are not spoiled, though they be leady and mingled with them, and so bring them among the *Copper-stones*, in the *roasts*, which will afford but little profit, therefore 'twill be more profitable to melt them. 6. *Spar-stones.*

Further observe, If one would melt the stone, and beat the *hard lead* and *Litarge*, care must be taken that one doth put in the *hard lead* and *Litarge* when the stone is in the Oven; and then the *lead* needs not stand so long on the *harth* among the *copper* and *slacks*, and thereby burn: but it were better to refresh the *Litarge* and *hard lead* fully (after the *Goslarish* manner) whereby you 7.

CHAP. XXVII. may make (with one labour in one day and night) 100 *Centner* of *fresh lead* which elſe is loſt, but when the Additions are to be made with it after it hath been refreſh'd, then there goes nothing more off in the little by-Oven, only that it will flow and work through amongſt the *Copper*, and ſuch refreſhing of the *hard lead* and *Litarge* may be done (if one thinks it not too great a labour) that the work might go the better.

Section. 8. *How to make the Oven and caſt the freſh pieces.*

When the *Melter* thinks fit to ſhut the *Melt-Oven*, then he muſt make the *Crucible* in the *harth* a little narrow and deep like a *freſh Oven*, and near that *Oven* another little *Oven*, in which the wind may drive, and wherein he may alſo warm the added *lead*; and when he begins to ſet it, and hath two *centners* of the weighed *roaſt* upon the *Oven*, then he muſt put in ſome weak *ſlacks*, by which he may ſee when the two *centners* of *roaſt* are throughly done when thoſe *ſlacks* do come, then he ſtops the hole of the *Oven*, and draweth off the *ſlacks* and *ſtones* from the Copper: and then take out of the by-Oven the hot *lead*, and the Copper in the crucible, with a warm *ladle* to reach into the *crucible*, and take out a ladleful or two, that it may come among one another, and then he muſt caſt into the pan the firſt freſh pieces, and when it is caſt then weigh it, by which you may eaſily ſee whether the deſired *copper* be come: and when the firſt two *centners* of the roaſt are melted throughly, and the weak ſlacks do come and the *Eye* or hole of the *Oven* is ſtopp'd, then the *Melter* muſt ſet up another *heap* of two *centners* of the weighed *roaſt*, but whilſt he caſts the *freſh pieces*, the *Melter* muſt take out again the gathered Copper which flows out upon the *harth*, and warm another weight of *lead* in the little *by-Oven*, that the work may go ſpeedily on, and not be hindred.

When theſe two *centners* of *roaſt* are ſet in the ſecond time

time, then the *Melter* muſt put in again ſome of the weak *ſlacks*, and when they come, then he muſt ſtop it (as before) and draw off the *ſlacks*, and muſt take the *lead* out of the little *by-Oven*, and caſt the *freſh piece*, thus he may melt continually as long as he hath *Copper-ſtone* to put in. CHAP. XXVII.

10. Such freſh pieces when there are enough, caſt into the melting-*Oven*, and they are to be melted off, while other *freſh pieces* are melting and making.

11. *The profit of this Aſſay work.* This melting-work is (in my judgment upon ſuch Copper-*ſtones* which yield *copper*) very profitable in compariſon to the other: becauſe you have the *Silver* quickly out of the copper, with the ſame Expence as is ſpent upon the *black Copper* making, and uſed with profit, better than when they muſt firſt be melted in the *copper*, and afterwards with great Expence to be wrought, and the *Silver* to be aſſayed out of it. Upon which every one who uſeth to melt may further conſider.

12. This alſo I think fit to mention for the Inſtruction of the common *copper-Melters*, ſo that all who care for it may be diligent in it: for this is not only a ſuppoſition, but proved in the great work.

13. What and how the *Thornels* (and other things which come by melting) may be melted and made to profit (as before is ſhewn:) the form of the Melting-*Oven* and of the little by-*Ovens* will be ſeen in the *Sculpture* following, which is thus

Deciphered.

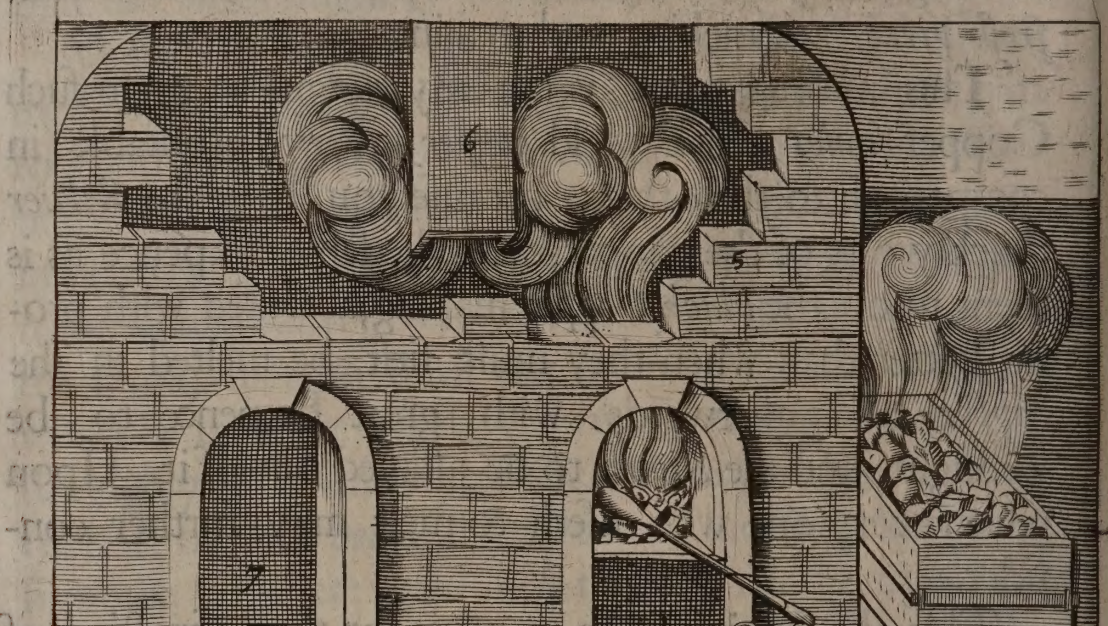
1. *The* Freſh Oven.
2. *The little* By-Oven *for* lead.
3. *The* freſh piece, *with a man lifting it.*
4. *The* Separation *of* roaſted *and* weighed lead, *brought by a man in a Wheel-barrow and laid in heaps:*

5. The

CHAP. XXVII.

5. *The Vault for the* Smoak *and* Duſt.
6. *The* Tunnels *to convey away the Smoak.*
7. *The* freſh Oven *without fire in the* Furnace, *or* fore-wall.
8. *The* Aſſay-Oven. 8. 8.
9. *The* little Pans *for the melted* Metal.

Sculpture XXXIV.



CHAP.

CHAP. XXVIII.

How Copper *is to be made* Braſs.

SO the *Braſs* burning as it is obſerved in *Cauffingen* in *Heſſen*, and as before in the City of *Goſlar* and in *Ilſenberg* on the *Haiz*, they uſe *Goſlariſh Lapis Calaminaris* which is ſometimes gathered out of the *Smelt-Ovens*, where (in ſmelting the *lead Oars* into 10 or 12 pieces) it ofttimes lyes about a hand thick; but the *Lapis Calaminaris* at *Galmay* mountains, and other mountainous places, (as thoſe near the River *Ach* in *Schwaben* or *Swevia*, in the County of *Tyrol* in *Auſtria*, and elſewhere) breaketh yellovv and gray, and is to be added to the *Copper* to make them of a *yellow Colour*, and which is called *Braſs*, but the *Goſlarſh Lapis Calaminaris* muſt be roaſted or burnt and ground ſmall upon a *Mullet* made on purpoſe, and then they prepare it as followeth. Section. 1. *Copper different in Countrys.*

They take one part of it, and tvvo parts of ſmall ground Coal well quench'd, and well mingled; dry them with one another, then pour a bowl-full of water upon the *Lapis Calaminaris* that it may every where ſuck it in, let it ſtand an hour and moiſten together, but ſome uſe *Urine* inſtead of *water*, and add a little *Allum*; this gives the *braſs* a fair *colour* in the firſt fire: then they have a crooked Inſtrument and draw all well together 3 or 4 times, then mingle it with a proportion of *Salt*, and draw it again with the *Inſtrument* twice or thrice, thus the *Lapis Calaminaris* is prepared: but they make alwayes ſo much *Calaminaris* together at once, as will be needful for two Ovens. 2. *To prepare* Lapis Calaminaris.

CHAP. XXVIII. When they make *Brass* they make round *Ovens* in the ground, so that the wind may force the fire through

3. *The Ovens for it.* the holes below in the Oven, and in one of these Ovens they set 8 pots or pipkins at once, and let them be warm and hot, and when they are so, take them out quickly, and put the *Calaminaris* in them, also they have a shovel made on purpose, that therewith they may take up and know how to distribute near 46 pounds in such eight pots. Then they lay in every pot upon the *Lapis Calaminaris* 8 pounds of small broken Copper pieces, and set-in the pots again, and let them stand 9 hours in a great heat, and in this 9 hours are to be taken one heap and a half of Coals, and when such Coals are burnt out, then stir the stuff in the pot with an iron, and see how 'tis flow'n, and let it stand in the *fluss*, and *graduation* an hour more, then lift the pots out of the *Oven*, and pour them (if you will have a piece of *Brass*) all in one hole, and while the stuff is warm, break them, yet so that they may remain and lye close together.

4. *Brittain stones.* Thus the *Brass* receives in the *breaking* a fair *yellow* colour, but if you make *Kettles* of it, and other work, then cast the *stone* into great pots and large pieces purposely for it, which *stones* are called *Britanish Stones*; or *Lapis Calaminaris*, (because they come thence) from which they cut afterwards some *Ingots*; and from them draw *wyers*, and beat out what they please for other uses.

5. Sometimes the *Brass-burner* sets in the *Brass* once more, especially if they will have the colour higher, but 'tis not with profit to be done, for the expence is more than the gain.

6. *The Proportion of Copper and Lapis Calaminaris.* ☞ Further, 'tis to be known, That the *Brass* receives in such burning a *heaviness*, for if you put in these eight pots 46 pounds of *Copper*, so the *Brass* will receive in 9 hours an increase of 26 pounds of *Brass*, so one poureth out again 90 pounds of *Brass*, this comes from one *Oven*

Oven in the week, as to 14 *fires)* to 3 *Centners* 34 pounds of *Brass* increase: And others say, That the *Goslarish Calaminaris* brings more increase than the *mountanous Calaminaris*, but it makes the *Brass* in the breaking *gray*, therefore in the glowing you must take care, that the stuff may not run in the work; and it must only be made glowing with the flames of wood. CHAP. XXVIII.

This I was willing to mention in short, how *Copper* is to be burnt to *Brass*, for their sakes who know nothing of it: But how the *Kettles* are to be beaten, and the *wyer* to be drawn and extended by water, is to be seen at *Ilsenberg*, in their works, and in many other places. Section. 7.

8. How the *Brass Ovens*, the *Pots*, *Shovels* and *lifting Tongs* are to be framed, *and* the *Britanish stone* dispo- sed of, the *Sculpture* following shews, thus

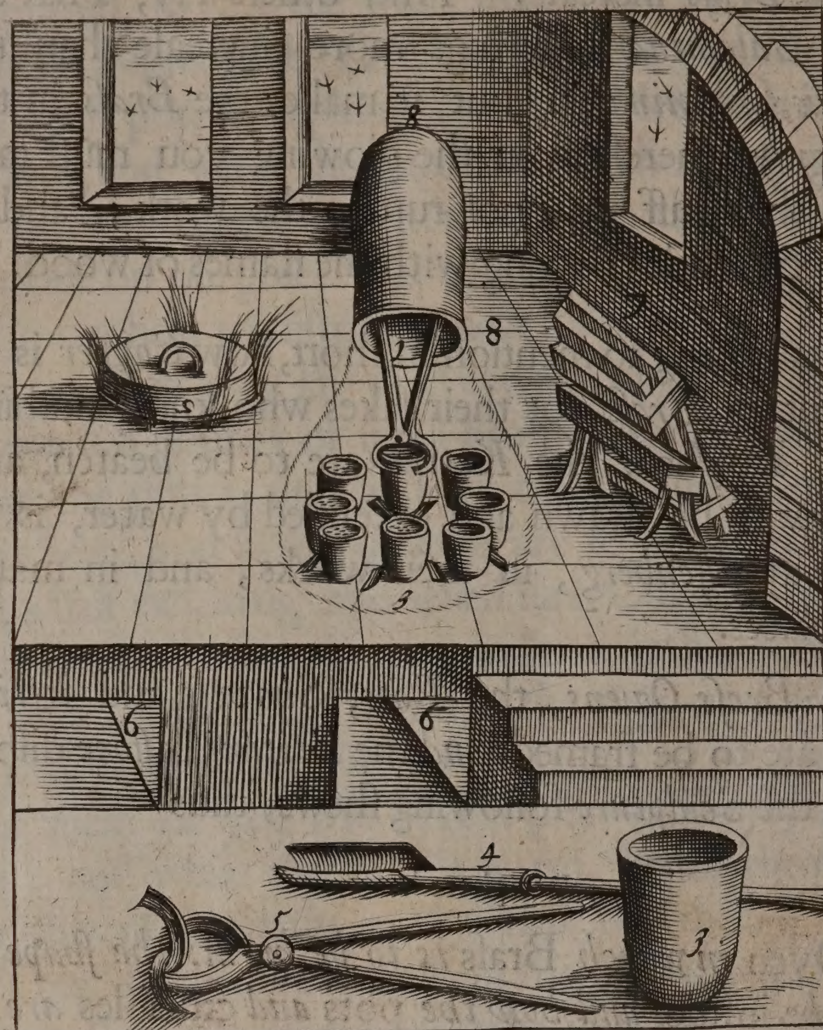
Deciphered.

1. *The* Oven *in which* Brass *is to be burnt: the shape of it in the* inside, *and how the* pots *and* crucibles *are to be placed in it.*
2. *How The little* brass Ovens *are to be placed in the other.*
3. *How the* Pots *and* crucibles *are to be formed.*
4. *The* shovel *to take up the beaten* Lapis Calaminaris *stone, which is to be mixt with* Copper *for the making of* Brass.
5. *The* tongs *by which the* Pots *are to be set in, and taken out.*
6. *The Wind* holes *in the* Oven.
7. *The pieces of the* Britanish stone *or* Lapis Calaminaris *unbeaten.*
8. *The place for the workman that sets in the* Pots.

Sculpture.

CHAP. XXVIII

Sculpture XXXV.



Thus I conclude the *Third BOOK* concerning *Copper* Oars, and its Labour, with other neceſſary Inſtructions appertaining to it; and the *Reader* may conſider further upon them: as alſo of other things which he may have occaſion to uſe.

The END of the Third Book.

OF
Lead OARS, TIN,
ANTIMONY, QUICKSILVER, IRON, STEEL, and the LOADSTONE.

BOOK IV.

CHAP. I.

Of Lead Oars.

THIS Book ſhews how to prove *Lead* Oar for *Lead*, and how the common or unſeparable light *Lead Oars* are to be ſmelted in the great ſmelting Work: next, how to prove an Oar for *Antimony* and for *Spelter*, and how to bring the *Spelter* out again: Alſo to try *Tin-ſtones* for *Tin*, and *Quick ſilver Oar* for *Quickſilver*: Alſo of *Iron ſtone* and *Steel ſtone*, for *Iron* and *Steel*, with ſome Inſtruments for *Tin ſope works*, and trying of *Tin ſtone* in the little *Oven*: and alſo of the wonderful properties of the *Magnet* or *Loadſtone*. Section. 1. *The Purpoſe of this Book.*

Now, concerning *Lead oars* they are uſually to be well known among the other *Metal oars*, for they are moſtly grey, *heavy*, *bright* of colour like the *Lead* it ſelf, and from its brightneſs is called *bright oar*; and ſuch bright colored *Lead oars* are the richeſt, and contain above half *lead*: then there is *white lead oar* like a *Sand-ſtone* and *red lead* 2. *Lead known from other Metals.* 3. *Bright Oar.* 4. *White lead Oar.* 5. *Red Lead Oar.*

CHAP. II. Section.

oar, like a reddish clay, these Two, *viz.* the *white* and *red* are heavy, but not so rich in *lead* as the bright: also

6. *Yellow lead Oar.* *yellow lead oar* mixt with *grey*, which is called, the *Lead ram:* These and such like Oars are counted the smooth-flowing and *deft oars:* and the heavyer they are, the more they yield in *lead.*

7. *Flinty Lead Oar.* But the *lead oars* which are poor, and taken from *flinty, blendy or mountainous* places, are either visibly or invisibly insperg'd or sprinkled with brightness (like the *Lead oar* at *Goslar*) and are very heavy: yet commonly no visible

8. *Unseparable lead Oar.* brightness in them, they are somewhat hard and unflowing, yet they do partly separate and purify in beating and washing, but partly they do stick fast in the water, that one with the other remain unseparated.

CHAP. II.

How to prove defty-lead Oars *for* Lead.

1. *The mixtures for it.* PROVING of *Lead oars* do require different observations (as in other *oars*, therefore the *pure-soft* and *flowing-lead oars*, you must prove thus, first grind the *oar* small, and weigh of it two *centners*, and put it in a *crucible*, with twice so much *fluss* which is made of *Copper oars*) with a little *Sandiver*, and mingle it with a little *filed Iron*, after this put also on the top of the *Crucible* a half square finger high of common *Salt*, press it down a little and cover the *Crucible*, and lute the joynings with a thin Clay, that no coals fall into the *crucible*, for that will do hurt, especially in the *Lead-Proof*, by reason the *fluss* will boil up in the *Crucible*, and the *lead* will not come together in one *grain*, but in the *flacks*, like *grains*.

When

When your *Crucibles* is thus prepared with the proof, then ſet it in a *little Oven*, prepared for the proof of the *Copper Oars*, put fire in it, and when the *Crucible* is glowing, blow very hard with a hand-*Bellows*, that the proof may have a ſtrong heat, ſo that it need not ſtand long: then take out the *Crucible*, and let it be cold, then beat it aſunder, and you will find below a *grain* of *Lead*, ſo much as the 2 *centner-proof-weights* will yield; then draw up the *Proof*-weights, and you will ſee how many *centners* of the *bright* or *deſt-lead Oar* will yield a *centner* of *lead*. CHAP. II. Section. 2. *How to diſpoſe it into Crucibles and Ovens.*

But to this proof muſt be added *filed Iron*, that the *Antimony* which is in the raw *lead-Oar* may touch the *Iron* rather than the *lead*, for if it had no *Iron* to conſume, it would begin on the *weak Lead*, therefore in many places, in the great fire, *old Iron*, or *Iron ſcales*, *ſlacks* and *ſinders* are to be added to the melting, whereby more *Lead* is produced: it hath alſo this ſervice in melting, that ſome *Lead* yields foul and unclean vvork, which by the Addition of the *Iron* becomes clean, for the *Antimony* or remaining *Sulphur* vvill give it ſelf (in the melting in the *Lead*-Kilns) to the *Iron*, and will come away that ſo the *lead* may be pure. 3. *Iron is to be added to the melting of lead.*

But ſome *Aſſayers* pretend to ſet the *Grain-lead* upon a *Teſt*, which in proving is found below in the *crucible*, and let it drive, ſo it vvill become clean: which is falſe, for the *Lead* being a vveak-*volatile Metal*, eaſily conſumes it ſelf in the fire: therefore I judge that vvhen the proof hath once ſuffered the fire, the *Lead* vvill become good and clean, unleſs the *grain* of the Proof be not clean, and that there doth hang on the ſame *Lead*, ravv glimmer or ſtone, which is a ſign that the Proof hath not received its due heat, which ought to be obſerv'd by the *Aſſayer*) and then he muſt make the proof once more. 4.

CHAP.

CHAP. III.

How to prove an undefty, Lead-Oar *for* Lead.

BUT the right lead Oars (which have with them fome flint, or other harfh ftuff) they prove thus: Beat the *lead Oar* into pieces, as fmall as grains of *hemp*, and weigh of them 2 *centners*, and fet them in an *Affay teft* in a proof *Oven*, and roaft them, but make it not too hot at firft, that it may not run together like *Sinders* (and do juft as is above mentioned with the *Copper*-proof) then grind the *roaft-Oar* very fmall, mingle it with the *flufs* (covered with *falt*) and you need no *filed Iron* to this, for it ☞ hath two *contrary Sulphurs* which confume one another, fo that the *lead* will remain fure, then boyl the proof in the little *oven* before the *bellows* (as before) thus the *lead* will be right in the proof.

CHAP. IV.

How to prove poor feparable Oar *by* boyling *it, and trying it by* fmelting.

MANY times alfo *Silver* containing *Lead glimmer* do break in the *Oven* (being infperged with *ftony-Oar*) but when you have a feparableOar, let it feparate it felf from the glimmer in the water, *viz.* when the *Oars* are beaten that they may be drawn in wafhing and cleanfing to a pure Oar: of thefe

1. *A good way of beating Oar.*

I

I muſt mention ſomething for the good of the *Mine-workers*, what difference is to be obſerved in the *beating*, becauſe oftentimes by Negligence comes dammage; but firſt of the *try-proof* in the little work. CHAP. IV.

Take a common proof of the *light oars*, beat it ſmall and mingle it well, weigh of it by the Proof-weight 20 *centners*, more or leſs, and draw it into a Tub to a clean Oar, and gently ſeparate this from the *light*, and weigh how many *centners* of clean oar, the *waſh'd common oar* will yield; and then you may eaſily reckon how many *centners* of *common oar* will yield a *centner* of *good oar*; and this pure *oar* may come to be ſo by the beating, ſifting or waſhing it, (and do waſte and prove, as above) but the good clean and bright *oar* is proved upon *lead*; thus you have the *content* of the *Lead*. Section. 2.

3. Now concerning the *beating* in the *great work*, the *lead Oar* you know is a heavy Oar, yet 'tis ſubtile and eaſy to be beaten into *duſt*, which ſwims upon the water, and goeth forth; eſpecially, if the ſame be in a *glimmery* or *flinty*, or *horny ſtone* (which Quarryes or *hornſtones* do afford) to which add the *glimmer* in beating, and make it duſt, and this *ſubtile duſt* (which is the beſt of the *Oar*) doth oft times yield a *blew, duſt* which will lay it ſelf on the great walls or ſtones in the waſhing, and comes to no profit.

4. *A hurtful Beating.* But, ſome uſe the *Beaters* or *Workers* (which build the *Beat-works*) to prepare thus the wet-works, *viz.* That the hindmoſt *ſtamping Peſtel* which beates the light or rocky Oar from behind, and beats againſt the *lamins* or *plates*; underſtand it in this manner, That the *hindmoſt Peſtel* may fall firſt, then the middle one, and at laſt, the firſt next the *Plates*.

This beating is not profitable becauſe it cauſeth great dammage, by reaſon that the beaten ſtuff or rocky *Oars* ſet themſelves before the *Plates*, ſo that the *graind Oar*

Chap. V. Section. 6. *Difference in Beating.*

cannot well come through, but beats it ſelf into a ſmall or ſubtil *duſt*, and goes away in the beaten or waſh'd *ſtuff*, therefore many *Waſhers* eſteem the *dry-beat Works* better, where one may work over the *Seeve*, and have the great and ſmall *Oars* aſunder, and alſo make more ſorts than with the *wet work*, which is found that if the *wet-beaten work* is built and prepared thus, the poor or *rocky Oars* will be beaten back from the *plates*, *viz*. that the Peſtle neareſt the *plates* will fall firſt, then the middle one, and at laſt, that which is behind, thereby the *plates* will remain *clear*, and the holes will not be ſtop'd, but the water will carry the pure *Oar* through without hindrance, whereby not only more *Oar* will be preſerv'd, but alſo the *Oar* may be made great or ſmall, and ſo to greater profit : and having found this in the work, I would not leave it unmentioned being ſo fit for every *Mine-worker* and *Aſſayer* to know.

CHAP. V.

How to try common Lead-Oars *for* Lead, *in a little* Oven.

LIKE as the *Copper* Oars (mentioned in the Third Book) are to be try'd in a little Oven, ſo may it be done with the *Lead Oars*, eſpecially if they are very clean, right and good, let them be thus beaten raw, as ſmall as half an *Hazel nut*, then ſet them upon a little Oven, but it were better 3 or 4 pounds of ſuch ſmall beaten *oar* might be laid firſt upon a Teſt, and gently roaſted, and then beaten and roaſted again, that its great *wildneſs* may come off, and ſo the *lead* will eaſily ſeparate from the *ſlacks* without other Additions.

CHAP.

CHAP. VI.

CHAP. VI.

How the inseparable *and light* Lead Oars *are to be assay-ed in a* little Oven.

Section 1.

CONCERNING the light-common-Lead-Oars, which do not separate in the water, they must be beaten in like manner as is spoken of the *separable*; only they must be roasted somewhat better, and when they are thus prepared, then melt them through the little *Oven*, but when the *lead* is not come altogether, then beat the *flacks* very small again, and take the clean *lead* from it, as you separate the *stone*; Now when the *Lead oar* is *flinty* (if one be diligent) then weigh the *lead* which is cleanly separated, and make your account how many *centners* of Oar may yield a *centner* of *Lead*; but if the *lead oar* be very *coppery*, 'tis to be roasted, whereby in the proof melting the *Copper* will come among the *lead*, therefore it must be separated upon a very flat harth, and you must cause the *lead* (as above in the *Copper* proof direction) to run-off with a gentle fire, and so the *lead* will become clean, and the *Copper* will remain setled, and this makes clean work (as you are taught before.) But the little *oven* for proving the *lead oars* must be prepared (like to the *Copper* Oars and *flints*) that you may bring out the *flacks* and *lead* very clean, as such practise will shew. *In the little Oven*

2. *In Crucibles*

But in the *Assay Crucibles* the proof must be thus: Take the light *lead oar*, grind it small, weigh two *Centners* of it with thy *Proof-weight*, set it upon a *proof Test* in the *Oven*, let it roast till it stink no more of *Sulphur*, then grind it small, put it in a little *Crucible* with four

Cent-

Chap. VII. *centners* of the *flufs* (which is uſed to the *deſt lead Oar*) put in it alſo melted *Sandiver*, and cover it with *Salt*, lute it with *clay*, and let it boyl in the little *Oven* before the Bellows, blow more ſtrongly to this proof than to the clean bright proof, and thus you have the Content right.

3. *Unroaſted.* You muſt alſo know, That every *lead Oar* may be proved unroaſted; thus, Grind it ſmall, weigh two *centners*, uſe the *fluſs* to it (according to Inſtruction given) only with the *Sandiver* take among it raw *Argol*, mingle it together, cover it with *Salt*, and the *crucible* with a covering: Lute the joynings with clay, and ſet it in one of the little *Ovens*, blow ſtrong to it like to a *Copper proof* (as above) thus you will find the Content of the *Lead*.

CHAP. VII.

How to make a Lead-Proof *on a Table or in a Stove.*

THE *Lead oar* to this proof muſt be very clean and good, take and roaſt it a little, then make a *fluſs* of two parts of good clean *Salt-Petre*, and one part of ſmall ground *Coals* mingled together, put two parts of this *fluſs*, and one part of the roaſt *Lead oar* alſo well mingled into a *Crucible*, caſt a little glowing coal in it, then it will begin to burn, and the *Lead* which is in it will flow together, and although this is an uncertain proof (not to be truſted to) yet thereby one may learn to know the property and nature of *Minerals*.

CHAP.

CHAP. VIII.

CHAP. VIII.

How to make Lead Oars *(though they will not separate in the water) to be profitable.*

ALTHOUGH I intend not to write much of the smelting, and thus to mingle what pertains to the smelting and lesser proving; yet I could not but leave somwhat to signify of *smelting* of the *light lead Oars*, because 'tis necessary, and no common labour, but to many unknown. Section. 1.

The *Lead-oars* which are poor, and will not separate in the Water, are *flinty Glimmer*, or such as come from *unseparable Oars*, and yet to be made to profit (if one have a pretty quantity of them) but not by the common *smelt-work* or *arch'd Oven*, for there the wild and *sulphury slacks* of the *oars* consume the *Lead* very easily, that almost no *Lead*, or not half so much as in the little proof is found or can be made, but only after the useful melting at *Goslar*, with which the light contenty *lead Oars* of the same place are to be smelted in a great quantity, and by no other ways, as by me and many others have been tryed.

Rocky lead Oar.

2. *The Sulpher Slaks, devour the Lead.*

But that you may have a sure Instruction for this work, and how such *volatile oars* may be help'd, I shall therefore describe the whole *Goslarish* Method, which they use in preparing their *Ovens*, &c.

First, I will signify what manner of *Lead-Ovens* there are at *Goslar*, and what they contain, that one may the better find out what doth follow.

The *Lead Oars* at *Goslar* are commonly *black Oars*, also a *white-gray flint* with *insperged Copper flint*, and

3. *Goslarish Lead Oar.*

CHAP. VIII. are very *ſhining*, which *Glimmer* is not to be ſeen in the *Oar*, but apparently in the *melting* and *ſlacks*, a *Centner* of the beſt of that *Goſlariſh oar* (if there appear not *Glimmer*) doth not contain above 16 pounds of *Lead*, but of the common *Oar* (mingled among the *flint* which cannot be ſeparated from it, and breaketh the moſt) uſually there is but 7 pound of *Lead*, and of the lighteſt leſs: this alſo hath an *Oar* Quarry which ſtands intermixt with it, and this *Oar* is to be roaſted in very great *Ovens*, and to every one three fires given; and then a *Centner* will contain but little above 5 pound of *Lead*, and one dram of *Silver* (notwithſtanding it contains ☞ more before the roaſting) which I judg doth come of this, that in the roaſting ſuch *Oars* there comes among the others, light and good; and therefore the Content is more equal, and theſe 5 pounds of *Lead*, and one *dram* of *Silver* are for the moſt part melted out in the Smelting.

4. *Two melt Ovens upon one water.* Secondly, In the ſame place muſt be no more than two *Smelt Ovens* to one *ſpring* (though the Melters think (if it might be ſo for the *Waterfalls*-ſake) that it were better that every *Smelt oven* ſhould have his own *ſpring* and *wheel*, becauſe every one might order his Bellows moſt advantagiouſly, which muſt be with great might and with heaps (as will be ſhewn) to force the Oar through the *oven*: yet it is at all times ſet through the ſmelt *Oven* nearer the *Wheel*, than through the other, and ſo where is more ſet, there is more *Lead* made, and with more profit of the *Coals*.

5. *Smelt Ovens.* They make ſuch *Smelt ovens* inward, within a wall of two bricks and a half deep, and two bricks wide, and the Walls above it, two ells and a half high, of *Shifferſtones* which are not thick, that one may, when he will, break out the Oven for the *Lapis calaminaris*, which grows in it (as hereafter you may hear) for the *Shiffer* or

or *flackstone* in the same place will very well indure the fire, and they do lay the foundation of the same two ells deep under it, crossways; that it may go out against the bellows, yet some foundations extend or reach to the *wheel-room*, but I do not approve of it, for if they become moist thereby, or draw moistness to it self, then it is hurt in melting, therefore it matters not a little that the *smelt Ovens* be right in their wideness and hight, as also that the Foundations be in their right places, that no water may come in, not too deep nor too moist, for if the water go on the Foundations, then the *stuff* in the *Lead* will not separate nor work well; also that the forms may lay right according to every kind and condition of the *Oar*, neither too sharp nor too flat, which should be fitted that the Bellows may blow in the midst of the *stuff* in the *Oven*, just near the forewall; The *smelt Ovens* at *Goslar* have very great Bellows, of six *Ox* hides to one *pair*, to force the *Oar* through in great quantities, therefore the Bellows must be strong.

CHAP. VIII. Section.

6. *Two Crucibles for the Lead.*

Concerning the *Crucible* in the *Oven*, it must be made thus, Lay upon the Foundation a great stone, which is called the (*Crucible*-stone, upon this they make a harth of *Clay*, mingled with little *flacks*, and upon it, another harth of *Clay*, and when 'tis dry they wash the *Crucible* which is half in the *Oven*, and half out, the middle standing right under the Wall) with burnt *Oars* of a thumbs thickness, and when 'tis dry and well warm'd, that it will glow very well, and become firm in the *Crucible* like *steel*, then the *smelt Oven* is prepared till the closing: but such a *Crucible* must be to the *smelt Oven* five quarters of an ell deep, and without the *oven*, it must so bend it self that the *Lead* may come to stand before the *oven* in the *Crucible*, and not in the *oven*.

7. *The Closing the work in the Ovens.*

When all this is done, then they put a vessel with Coals in the warm *Crucible*, and upon the Coals three

Vessels

CHAP. VIII. Veſſels full with light *coal-duſt*, which they make thus: They make on the Wheel on the end of it a *Beater* or *Mallet*, and as the wheel goes round about, then the *Mallet* falls down twice upon little hard coals, which the ſervant of the *Melter*, when he hath time doth put under with a Shovel, albeit it is a ſlow work, yet they make ſo much *duſt* with it as may ſerve two *ovens*, for they are not willing to lay ſo great a burden upon the Wheel, but they beat no Clay with it (as they uſe in the *duſt* in other Smeltings) then they moiſten their *Coal-duſt*, and force and beat them with ſome heavy thing, into the *Crucible* in the *oven*, (commonly with an *iron Beetle*) that it may not come upon one another, and alſo before the *oven*, vvhere they make it a little higher, that the *ſlacks* may not flovv out, and leave a hole open belovv on the *oven*, under the *forewall*, (which is called an *Eye*) that one may almoſt reach his hand into the Oven.

8. *Of kindling the Fire.* After the preparation and *cloſing* of the *oven*, they put on the Top of it *glowing* and other *Coals*, and after that a dray or tvvo full of their *ſlacks*, then *coals* again, upon it the burnt *oar*, and ſo continually *coals* and *oars* till the Oven be full to the top, alſo they lay before it *live coals*, but not many, only that the *duſt* may remain *warm* near the fore-vvall, vvhere the *ſlacks* flovv out: Novv vvhen the *oven* is ſet full, they ſtay till the fire burn in the Oven, and then they begin to melt, and make the Oven vvet, vvith vveak *ſlacks*, as in other meltings: neither have they *Iron-ſtones*, but *copper* which is to lye ☞ pretty far in the *oven*, for the *Iron gratty ſlacks* vvill devour the *Iron ſtones* quite in tvvice vvorking, which they do not ſo eaſily to the *Copper*: yet in time they do conſume alſo, ſo that they muſt be renevved once in a quarter of a year.

9 Their time to melt is 23 hours, in this they ſet into one Oven 66 to 70 *Centner* of *roaſt oar*, and the *oar* vvill flow

flovv like vvater, and vvorks it ſelf very freſh, and there is nothing elſe to be taken to it, but only the burnt *Oar*. CHAP. VIII.

Section. 9. Now, when the Melter lifts off the uppermoſt *flacks*, (which is very heavy and thick) the reſt under it will ſtand very clear, and then with a great *iron Ladle* he pours them out, which will run like *lead*, ſo freſh as they are, and the *flacks* look like a melted *flack-ſtone*. But the *lead* creeps through the light *duſt* in the Oven, and hides it ſelf under it near 23 hours, and therefore the wild *Sulphuriſh flacks* cannot reach it, nor the long during heat conſume or devour it.

10. *Opening the Oven.* When the *Melter* hath obſerv'd his time, then he opens the *Funnel* below, and takes out the light *duſt* together with the *flacks* which are ſettled in it, and whilſt the *Melter* is drawing the *duſt* out of the *Oven*, a ſervant muſt gently pour water, that the *Melter* may endure the heat, and when all the *duſt* is drawn out, then the *Melter* with his fork ſtirs the *Lead* in the Oven below, ſo that all the *Lead* may come together, then he caſts the *Lead* into the *harth* ſtanding by the Oven, and it muſt be kept warm continually.

11. *Of the Cakes or Sows of Lead.* Out of this he draws it into *Cakes* or *ſows* of *Lead* (according to the old *Fryberiſh* Method, and brings out of the 60 or 70 *Centner* of melted *Oar* (in ſuch a time well melted) near three *centner* of *Lead*, of which one *centner* contains 4 *loths* of *Silver*, and the reſt of the *Lead* and *Silver* will remain in the *flacks*; and though there be almoſt as much yet remaining, it is a Wonder that ſo much ſhould be produced out of a poor *contenty ſtubborn Oar*.

12. But if you would melt other *Oars* beſides this (after the *Goſlariſh* Method) you muſt be careful the *Oar* may vvork it ſelf freſh; for if it do not, then you muſt help it, for the light *duſt* cannot ſuffer the very *ſoft flacks*, alſo

CHAP. VIII. when the *light lead Oar* contains pretty much *Silver* and little *Lead*, then at all times, according to the condition of the *Oars*, there may be added hard *Lead*, that the *Silver* may have a refuge into the *lead*.

Section.

13. *Galmay*, or *Lapis Calaminaris.* I must signify, that in the *melt* Oven of the *Goslarish Lead oars*, they lay on all four walls of the Oven a *gray* with a *yellow mingled matter*, every *Row* or *Lay* as thick as a straw bredth) which they call *Galmay*, used in the brass-melting (and adding as you have heard in the end of the *Third Book*:) and this matter must be put out of the *melt Oven* after 8 or 9 *Rows* or *Lays* are made, else the Oven will be too narrow, so that no more can be melted in it with profit.

14. Thus much I was willing to mention of *Lead oar* and *Lead*, that every *Mine* and *Smelter*, who will imploy himself in it, may know how every one may be help'd; for 'tis a weak *tender Metal*, and may in *Smelting* quickly be hurt: And, 'tis manifest, if this way of *Smelting* of *poor light oars* of *Goslar* had not been invented (by which they make their *Lead*) neither the *City*, nor the *Mine-work* could have been thus long useful, having continued these 700 years, and by the help of the Lord may longer continue. The following *Sculpture*

The Goslar Mine 700 years continuance.

Deciphered.

1. *The The* Walls *of the* Furnace.
2. *The* Lines *on them, shews the* Gradations *of the* Metal *descending.*
3. *The* man *that manageth the* metal *in the* furnace.
4. *The* back *of the* Furnace *with the* coals *and pieces of* metal flaming.
5. *The* grand Test.
6. *The* Oven *for that Test.*
7. *The pieces from the* Test.
8. *The* man *that beats the* Oar.

9. *The*

9. *The pieces of* Oar *and* Cinders. CHAP. VIII.
10. *A heap of* Charcoal.
11. *The* water-troughs *to wash the* Oar *in.*
12. *The* Pipes *by which the* foul water *is cast out.*
13. *The* Instruments *for the* Furnaces *and* Tests.

Sculpture XXXVI.



CHAP.

CHAP. IX.

Of melting Oars *with* Moll *or* Turf.

BECAUSE ſome years ſince the *Miners* and *Smelters* have pretended that all ſorts of *Oars* might be melted with *Sods* or *Turff* (as the *Saxons* call it) I could not omit in this part, but give the *Reader* my Judgment. And becauſe the Oars are not all of one ſort,but partly harſh and hardy, and partly mild ſaft and flowing, and that the *Turf* yields very heavy and much *Aſhes*, which in the *Melt oven* comes to be a *ſlack* (almoſt like a *Glaſs*) I judg it muſt not be uſed at all to the weak *oars*,to which this ſeparating Work is unprofitable, for through their many heavy *Aſhes* the *weak flowing oars* are hindered, and the Oven thereby ſtopped,and though you uſe half coals with it, yet it would not turn to profit. But what are *harſh-hot-graty Oars*(eſpecially *roaſted lead oars* by help of *Coals)* may be melted, and it will be ſerviceable, for they will work themſelves more ſeparable and deft : ſo that one need not much other addition (as aforeſaid.)

The property of the Molls.

But if one would melt ſuch *harſh Oars* with *Turf* only, I fear the Oven will be ſtopped many times,by which the work will be much hindred ; therefore I conclude it better to melt with *Coals*, than with *Moll*, *Sod* or *Turf.*

Chap. X.

CHAP. X.

How to prove Spelter *or* Wizmet *Oar, which some call* Bizmuth.

SPELTER *Oar* is a *white heavy Oar*, and yields among other *Oars* the most *flowing* Metal, which needs no singular Pains to melt it down: But there are two sorts of melting it, in the *Wind*, and before the *Bellows*; as will follow: for, if you will prove this *Oar*, how much *Spelter* it may contain, then grind it small, and weigh a *centner* of it, and two *centners* of the *fluss* (before spoken of, made of *Argol* and *Saltpeter*) mingle it, and put it in a *Crucible*, covered wit *Salt*, and cover it, Lute it with *Clay*, and boyl it up in a little Oven before the *bellows*, like (to a flowing *Lead proof*) thus you will have the *Spelter* below in the *Crucible* like a *lead Regulus*; draw it up after thy proof weight, and you will find how much *Spelter* a *centner* of *Oar* yields: but, till of late, we had not the vvay to melt so much out of the *Oar*, as hath been found in the proof, and the difference is alike, for we finde almost the half part more in the little proof, vvhen the *Spelter* is melted out of it: But, as it hath been mentioned in the *Tin-flacks* (vvhich by a strong fire vvill melt the remaining *Tin*) so it is possible to do vvith the *Spelter*. Section. 1. *Two sorts of Spelter Melting.* 2. *The Difference of the Content.*

But to melt the *Spelter* out of the *Oars* tvvo methods are used: one by the *wind*, the other by *Bellows*: the vveakest sort of *Spelter Oars* are to be melted on the *wind*, vvhich is to be done thus; Take of the *Oar*, and beat it to little pieces, about the bigness of *Walnuts*, and put it in little *iron Pans* (set in order) that they may spread 3. *To melt on the wind.*

CHAP. X. ſpread abroad, and ſet them in the field in the winde, and make a fire of dry wood, ſo that the wind may bring the *flame* into the *pans* upon the Oar ; thus the *Spelter* will flow quickly out of the *Oar* into the *pans*, and when 'tis almoſt flown out, ſtir the *Oar* about, that what the *flame* hath not touch'd yet, may be melted all out.

Section. 4. This is the true proof for the *Spelter oar* (and the right melting) becauſe after this, can nothing more be melted out of it ; then lift the *pans* off the fire, and put out the *oar*, and make the *ſpelter* clean, let it be cold, and put freſh *oar* into the *pans*, and melt continually ; this *ſpelter* ſo melted is the beſt and cleaneſt, and ſome *centners* may be made at a melting, which melting is clearly to be ſeen in the following *Sculpture.*

5. *To melt in the Oven.* The other way of Melting it, is thus, make the *Oar* clean and beat it ſmall, and prepare a little Oven, a good *ſpan* wide below, and four *ſpans* high, and above two *ſpans* ſquare, then place a weak *Bellows* (like a little *Smiths* Bellows) behind, and in this melt the *ſpelter Oars* or *ſticks* with wood and ſoft Coals ; and before it be all *ſlacks*, draw it out of the Oven into a *trough* of wood, made on purpoſe, and in this ſtir the glowing Oar to and fro, and ſo the *ſpelter* will flow together, then ſeparate it and make it clean ; what remains at laſt of the

Zevar Colour. droſs (by either way of Melting) makes a blew *colour* in great quantity, and may be uſed for *glaſs* to give it a blew, 'tis here and there ſold to the *Glaſs-houſes.*

Sculpture

CHAP. X.

Sculpture XXXVII.



Deciphered.

1. *The little* Iron Pans *for Spelter or Wismet* Oar.
2. *The* fire *of* vvood *for them.*
3. Melted Spelter *that is to be made clean in the* iron Pan, *and the workman that tends it.*
4. He *that draws the* Oar *out of the* Mine.

CHAP.

Chap. XI. XII.

CHAP. XI.

Of Tin.

Section. I. *Tin-stone or Zwitter.*

ZWITTER or *Tin-stone* whereof *Tin* is made, is heavy Oar, yet the *Metal* which it produceth is the *lightest* of all other *Metals*; the *Zwitter* is to be known by its brown *colour*, which inclines a little to *yellow*, yet the rich *Zwitters* are black and of fine growth, and so smooth as if they were polished, and very rich in *Tin*, yet sometimes the *Zwitters* are found in another form like *Iron stone*, or a pointed *woolferan* Oar (which the old *Miners* have not known) therefore 'tis needful to prove the *Zwitter* with diligence whether it be *Tin-stone* or not, and whether it yields much or little, that the *Mine-workers* may the better know what to do.

But the *Tin-stone*, as well in the little proof as in the great work, must not only be burnt, but also purified clean before the melting, otherwise it yields not so much *Tin*, as when cleanly prepared.

Yet, 'tis to be known that every *Tin-Mine-work* hath a singular manner to prepare the *Zwitter* or *Tin-stone*, which is to be admired.

CHAP. XII.

How to prove Tin-stone *for* Tin.

I. *The way of Proving it.*

ALTHOUGH the proving of the *Tin-stone* how much properly doth contain a *centner*, be an uncertain proof, yet by it thus much may be learnt, that one may know whether the *Tin-stone* be good or light, likewise what happily

ly may be made of Tin, and to know its true content, and the most common way to be used therein is as hereafter followeth. CHAP. XII.

First, when you have taken a common proof of the *Zwitter*, or *well-beaten Tin-stone*, then grind it small, and weigh of it with thy proof-weight what you think fit, and draw that which is weighed off into the *slick* or *dross*, and weigh that too; then set it in an *Assay-oven* upon a *test*, and roast it in a pretty heat, and when it is cold again, grind it, wash that which is light in a wooden *trough*, and weigh the clean *slick* again, and observe how much goes off from the *slick* in the roasting and shifting, and do this two, three or four times, till the stone is very clean, and that nothing more goes off from it; thus 'tis prepared to the proving.

Section 2. *In the Coals.*

Of this prepared *Tin-stone* weigh two *Centners*, and mingle among it small ground *Pitch*, and take a glowing *hazel* or *Lime tree coal*, or any other that doth not spring or break in the fire, but remains whole, cool it in the sand, and cut in it a *Channel*, and at the further end of the Chanel, make a little hole, into which put the mingled *Tin-stone* above, upon the broad place of the *Channels*, and lay upon the same Coals, other *Coals*, just as broad as the first, for which you must also have a hole below and above, that the *Bellows* may blow between, and lute the *Coals* on both sides, that they may remain together; and when 'tis thus prepared, lay it together with a cool temperate fire, so that the *Tin-stone* may come above and in the little hole (in which the Tin is to flow) lay glowing coals upon it, and blow it with the *Bellows*, so that the blowing may just move upon the coals in which the *Tin-stone* is, so the Tin will flow out of it with a fresh *flame*, then lift the *Coals* out of it, and let it cool, and weigh how much Tin the two *Centners* of the prepared *Tin-stone* hath given, then you may make

 account how many *Centners* of the *common Zwitter yields* a *Centner* of Tin, this I judge the ſureſt proof.

3. *With the Fluſs.* Then one may weigh off the prepared *Tin-ſtone*, and with the *fluſs* (made of *Salt-peter* and *Argol* mingled, and put into a *Crucible* and covered with *Salt*) boyl it in a little *Oven* (like to the *Copper* Oars) with the *Bellows* to give the *Proof* a ſtrong and ſuddain heat: for the Tin will burn eaſily in a ſtrong fire, and ſo you will find how much *Tin* the *Tin-ſtone* doth contain.

4. *Upon a ſudden Heat.* But the *Tin-Melters* have a ſingular proof upon the *bucking*, and *waſh'd* unburnt *Tin-ſtone*, namely, to cauſe a ſhovel to be very glowing hot upon which they put the *Tin-ſtone* that remains upon it, and ſpringeth not off, and doth colour it ſelf, this they account a good *Tin-ſtone*, but if there be much *falſe Oar* among it, they may ſee it, and I judge it more needful to prove the *Tin* this way, becauſe you may know whether it be good or bad, and vvhat may be made out of it, but for thoſe who have not long converſed with it, or well underſtand it, 'tis better to uſe the firſt proof.

CHAP. XIII.

How to try Tin-ſtone *in the little* Ovens.

WHEN the *Tin-ſtone* is cleanſed and burnt, then weigh an half, or vvhole pound or two of it: and ſet it through the little *Ovens* (as before is taught of the *Copper* and *Lead* Proof) and melt it with the *Bellows*, without any other Addition, whereby you may fully ſee how much *Tin-ſtone* it yields: but obſerve, if you will ſet the *Tin-ſtone* in the *little Oven*, or will melt it, 'tis to be put in wet

wet, and no ſmall or ſmooth Coals uſed to it, for the Tin cannot ſuffer the heat, like *Copper* and other Metals. CHAP. XIV.

CHAP. XIV.

*Of beating and preparing the Z*witter.

BECAUSE in preparing the *Zwitter*, commonly ſo much *Tin-ſtone* cannot be made and waſhed from it, as in the little proof, which I do impute to the uſeful and long obſerved *beating*, becauſe the *Peſtels* fall not (as I have mentioned above in the Lead-work) I judge the other *beating* (though not tryed and prepared upon the *Zwitter-work*) not to be unſerviceable for the dreſſing it; but by it more *Tin-ſtone* is obtained, and it ſtands with Reaſon, becauſe thereby the *Lead-oar* may be profitable to the *Zwitter* or *Tin-oar* which I leave to every ones conſideration and pleaſure. 1.

There comes often many profitable works to light by *trying*, which otherwiſe would have been loſt; as lately the Melting the old *Tin-ſlacks* which have lain long uſeleſs; alſo upon a new Method, that you need not melt them as before, through the *Zwitter* Oven, but over a common *Melt* Oven, which is uſed to raw Works, and may always add freſh, making it not only much but alſo good Tin. 2. *To melt old gathered Slacks.*

But becauſe commonly the *Melters* make not out of one Veſſel of *Tinſtone*, ſo much *Tin* as out of the other, that is not as I judge in *burning* and preparing; but the fault is in their way of Melting, elſe it were not poſſible to melt ſuch *Tin* out of the *ſlacks*, as now is propoſed. 3.

CHAP. XIV. Section. 4. *The loss in Burning it.*

I must further instruct the Reader, That I am of this mind in preparing and melting the *Tin-stone*, because 'tis sure, That out of the common *Zwitter* so much Tin cannot be made in the great proof, with the usual beating and melting, as is to be found in the little proof, because in *beating* and *melting*, there may be loss, (as above is mentioned) therefore it follows, That to this preparing and melting some better ways may be invented, in my Judgment sutable to this way.

5. *The way of burning it.*

For the *Tin* in melting cannot suffer so much, and is more *volatile* in the fire than *Lead*, and good clean *Tin-stone* goes off as well in beating, burning and washing as the *Lead oar:* and I judge it more profitable and fit to be tryed, that the *Tin-stone* be left in *grains*, and then well burned, but not made half so clean, as to the now usual melting; and when it is melted over the light dust with strong blowing (after the *Goslarish Method*) under which the *Tin* may hide it self, and remain sure, for the *flacks* and great heat: and I doubt not but by this way, out of 60 *Zwitters* may be made more *Tin* than in the common way of *melting*, considering the light Contents of the *Goslarish Lead oars* (are as is above written) which doth not separate in the water nor are made clean: but of the *Lead* which is in it, (as it is said) one *Centner* commonly contains but five pound of *Lead*, by reason of the light *Content*, and the many *flints* vvith the Oar, vvhich vvill not let it vvaste avvay, and in no other Melting can *Lead* be melted out of it, as by the admirable vvay of Melting in this place is discovered; vvhereby I judge this trying vvould not be fruitless, if it vvere truly tryed, yet I leave it to every ones considera-tion. But if the *Goslarish* Method should not be used to this, then I knovv that through their *Melt-ovens* it can no vvays be done.

Goslarish Melting.

CHAP.

CHAP. XV.

An Instruction for Tin-ſtone Work.

THERE are many ſorts of *Tin-ſtone* Working: ſome being rich and ſome poor; in the *Stone*, and in the waſhing there is much hurt by the great waters which the *Tin-workers* uſe, by which ſo much of the *Tin-ſtone* as is flowing and ſubtil runs avvay, ſo that for two, three or more Miles the *Tin-ſtone* is found under the Water: which in my Judgment may be the more profitable, becauſe a full *Mine-Tub* of the Waſh-work yields commonly one *Loth* of clean *Tin-ſtone*, and may be ſet over the *Seeve-work* and waſhed, ſo as a Waſh-man may do as much in one day, as two Boys can bring. Section. 1. Seeve-Work.

But ſuch cleanſing muſt be in a *Tub* of water with a hole in the bottom,that the *flicks* may fall through upon a plain harth, and yet the *Tub* be always full of water, and in this the *Tin-ſtone* is to be driven over the plain harth made clean and preſerv'd.

By this Work, if in one day 400 *Mine-Tubs* were filled and made clean (to which there needs but four perſons) there might in a Weeks time almoſt half a *Centner* of *Tin-ſtone* be made clean and gathered,and this were to better profit than the other uſual way; but I leave it to every one's pleaſure.

Chap. XVI. XVII.

CHAP. XVI.

To prove Tin *by Additions.*

Section. 1.

YOU muſt take clean *Tin,* wherein is no Addition, caſt it into a round Ball in a frame (made on purpoſe) cut the *Ingot* clean off, and take the *Tin* you would prove againſt it, and caſt alſo of it a round *Ball* like the other, and cut the *Ingot* alſo clean off, weigh the Balls againſt one another, as the pure *Tin,*and if they weigh alike, then they are of one ſort of *Tin,*but if one *Ball* be heavier than the other, there is Addition either in the Melting, or put to it afterwards ; but the lighter the *Tin* is, it is the better : but to know juſtly the *Addition*, you muſt have a particular weight made on purpoſe ; and when the Addition is found, then ſuch proof muſt be weighed againſt the clean wrought *Tin,* and the *Tin* Veſſels made for the *Tin,* upon divers Mine-works, will have a difference on the weight (as is mentioned of the *Coppers*) and the Proofs will not agree.

2. *The light* Tin *the beſt.*

CHAP. XVII.

How to prove Antimony.

ANTIMONY is a fine *heavy Oar bright* like *Lead,* yet *ſpizy,* and in *Germany* and *Bohemia* it is found in great quantity, yet ſome better than other : and now , becauſe it is uſed in ſome matters, I will ſhew the beſt way how to prove it : *viz.*

Beat

Beat two or three pounds of the *Oar* ſmall, put it in a pot vvith a hole at bottom, cover it, and ſet it on another pot, *Lute* the joynings, and ſet them between *Tile-ſtones* in the fire, that the lovver part may be cool, and that the fire may not touch it, let the upper part ſtand in a glowing heat, ſo the *Oar* will flow eaſily, and alſo the *Antimony* from it through the hole, then cool it, and take out the *Antimony*, ſo you will ſee how much *Antimony* thoſe pounds of *Oar* will produce, and accordingly you may order your ſelf. Chap. XVIII XIX.

CHAP. XVIII.

Of Quick-ſilver.

QUICKSILVER is a fine *red* and *brown* Oar, like *Gold Oar*, partly deft and partly *inſperged* in the *Mine*. To prove this Oar it cannot be done in an ordinary fire (as the other Oars are, nor melted out of it) but as a *ſpirit* muſt be driven off in a ſtrong *diſtillation*, for its Metal is in the fire *volatile* like a *ſpirit*. *Quickſilver Oar.*

CHAP. XIX.

How to prove Quick-ſilver-Oar *for* Quick-ſilver.

FOR the accompliſhing whereof, the beſt way is to take half a pound of it, or ſomewhat leſs, beat it as ſmall as half a Nut, and put it into a *Retort* or other well luted *Inſtrument*, and drive the *ſpirit* into another *Inſtrument* laid before it in

CHAP. XX. in water or other moiſtneſs, thus the vapours or ſpirit will preſently reſolve it ſelf in the coldneſs or wetneſs into *Quick filver:* But if one hath no *Retorts*, he may uſe a well luted *glaſs Bottle*, and ſet upon the *Bottle* a *Helmet* (which hangs over) in which water is to be put, and the joynings every where well luted, that no *ſpirit* may go out, then ſet the *Retorts* on the *Bottle* in a little Oven, and make firſt a gentle fire with wood, then ſtronger, thus the *Quick filver* will drive it ſelf from the Oar in the coldneſs or wetneſs, for the *Quick filver* loves coldneſs and moiſtneſs, and avoideth the heat as its Enemy: Now when you have found *Quick filver* in the proof, weigh it, and then you may ſee how much the Oar was which was ſet in, whereby your reckoning may be made accordingly.

But concerning melting of *Quick filver* in the *great Work*, do thus, beat the *Oar* ſmall as a little *nut*, put it into *Juggs* (made on purpoſe) in each about four pound: then prepare a *flat harth* of moiſtned *Coal-Aſhes*, on which ſet round *Teſts*, three ſquare fingers deep after one another, and turn upon it the *Jugs* fill'd with Oar, ſtop it well with the moiſtned duſt, about the *Teſts* and *Jugs*: then make a wood fire upon it, and the *Quick filver* will avoid the heat, and ſeek the cold which it finds in the *Teſt* below. *Jugs.*

This Labour in the great Work is to be ſeen in *Germany*, and in many places upon the *Mine-works*.

CHAP.

CHAP. XX.

Of Iron *and* Steel-ſtone, *how to know and prove them.*

IRON-STONE is *brown*, and its colour is ſo that commonly it looks like roaſted *Iron*; but the beſt and richeſt *Iron-ſtone* its colour is *blewiſh*, like to a *dug Iron*, and ſome of theſe *Iron-ſtones* are *Magnetiſh*, and draw the *Iron* apparently, which proceeds from their hidden *heat*, as ſhall hereafter be diſcourſed of.

CHAP. XXI.

How to prove whether the Iron.ſtone *be* rich *in* Iron.

Section. I. *Try'd by the* Load-ſtone.

DO this by the *Loadſtone*; therefore if you will try the *Iron-ſtone*, roaſt it (though ſome take it unroaſted) grind it ſmall, and take a good *Loadstone*, turn or draw it about with it, and the good will hang all on the *Magnet*, ſtroak it off with an *Hare's* foot, and lift the *Iron-ſtone* up again with the *Magnet* as much as it can bear, and if at laſt any remains that will not be drawn up, that ſtone is droſſy and not good: Thus you may ſee whether a *Mine* hath *Iron*, or whether the *Iron-ſtone* in it be rich or poor in *Iron*, for the *Magnet* (as is ſaid) lifteth up no other *Metal* but *Iron* and *Steel*. ☜

CHAP. XXI. Section. 2. *By the* Steel-stone. The *Steel-stone* and *Iron-stone* are alike, though not in colour, some look like yellow *sparr*, this the *Magnet* will not lift up raw: nor some *Iron-stone* at all; but if you roast the *Steel stone*, it colours it self, and is like the colour of the rich *Iron stone*, and then the *Magnet* will ☞ lift it very easily, and sooner than the *Ironstone*: and then the *Iron* may be made (with a long and strong heat, and with hard Coals in a *Secret* glow) without dammage to good *Steel*, and the common *Steel* by *Smith-working* will turn into *Iron* again.

3. When such proof is found by the *Magnet* that the *Ironstone* is good and rich, then the *Hammer-smiths* (with their Additions) use further to prove and try it, in the great fire.

The *Iron stone* being of an hot Nature, will not flow
4. *To melt* Iron-stone. or melt with a small fire, as *Gold* and *Silver* will, but it must be a great and strong fire, and when 'tis forced to flow out of the *Iron-Ovens*, many Instruments may be cast, and its hot *Sulphur* will flow from it: also upon melting of it, somwhat of its substance will come out, and though it be refreshed in the fire with fresh *Ironstone*, yet so much of its substance will go from it as it hath lost in the first melting. But when the *Iron stone* is to be melted in the high *Ovens*, or in the *running-work* (with a true Addition as every *Ironstone* requires) then let it force it self, yet the *twice melted* Iron is best for use, and most *deft* for to work.

Thus much of the *Ironstone*, how to prove what it yields in the little work: But how the *Iron* may be boyled into *Crocum Martis*, as also to get *Vitriol* out of the roasted *Iron* (of which the *Philosophers* write much) and how the *Iron* is to be wrought after several Manners and Methods, and hardned: But all this belongs not to proving of *Metals*, and so it falls not un-

der

der my Instructions, but the *Reader* is left to find out other wayes. Chap. XXII.

CHAP. XXII.

Of Magnets.

LOADSTONES or *Magnets* being mentioned in Book II. Cap. II. and in this IV. Book, I will discourse something of its Nature and wonderful Properties, because there is none amongst all *Jewels* which doth so naturally shew its Virtues as this *Jewel* or *Magnet*, and therefore I will let the *Reader* understand what *Serapion* an old *Philosopher* writes of it in his Book *De Simplicibus & Mineralibus*, where he sayeth thus, *Take the* Magnet, *lay it in an earthen Vessel, and add much of* Calx viva, *lute the Vessel well about with* Plaster, *and make a great fire under it, and let it stand in the heat till the fire goes through the earthen Vessel that it may well glow; then set the earthen Vessel with the matter to burn in a* Potter's Oven, *till the overluting be consumed on the* Test, *then take the* Loadstone *out of the Vessel, and mingle it again with* Calx viva *three or four times, and let it burn as before, and when 'tis taken out of the* Oven *the fourth time, then hold the* Magnet *in such a place that neither the Wind, Water nor Dew may come to it, nor any other Moistness, till it be cool, then beat it small and add* yellow Sulphur, *in like weight; Thus the* Magnet *is prepared, and if one do drop Water only upon it, a great fire will spring out of the* Magnet, *which would burn all that it toucheth.* Thus

CHAP. XXII. This was *Serapion*'s Opinion, againſt which I have nothing to ſay, whence the *Magnet* doth ſo vehemently love the *Iron*, and the *Iron* the *Magnet*, as though they were both of one Nature, and created one for the other; the *Magnet* being very deſirous of *Iron*, and draws it to it ſelf with its whole Power, and the *Iron* preſently ſhews it ſelf by ſpringing to it, and ſo remains hanging on it.

The *Magnet* is alſo called the *Sail-ſtone*, for the *Sailors* look upon it as their *Chief Inſtructor* in their way upon the Water, far and near; namely, after they have touch'd the little tonge or *Needle* in the *Compaſs* with the *Loadſtone*.

Alſo the *Magnet* is uſed to the *Compaſs Needle*, in the *Mine-work*, and to direct their *Glaſs* and *Audits*; and alſo in the famous and worthy Art of* *Separation*: and alſo with common *Miners*, the *Sun-Compaſs* is very uſeful; ſo for Brevity ſake, I will conclude this *Fourth Book*:, and deſire the *Reader*, for this time, to be contented with the *Inſtructions* I have here given.

* Mark Schiden.

The END *of the Fourth* BOOK.

CHAP. I.

OF

SALT-PETRE,

VITRIOL, ALLUM *and* Salt Springs.

BOOK V.

CHAP. I.

Of Salt-Petre.

Section. 1. *The Purpose of this Book.*

IN this Book *Salt-Petre Earth* is deſcribed, and its Properties, and how to be known, and how to make *Lees* of it, and of the *Waſhings* and *Boilings* of it, and the *Purifying* of the *Raw Parts* of it, and how the *Salt* is ſeparated from the *Earth*, and cleanſed with particular *Inſtructions* how the *weak Salt-Petre Lee* is to be made *richer* and boil'd to greater profit.

2. *Of Vitriol, Alum and ſalt ſprings.*

Alſo how to prove the *Flints* for *Vitriol*, and *Allum-Oar* for *Allum*, and of *Wells* or *Springs* of *Salt*.

Now, becauſe *Salt-Petre* is much uſed for ſeveral uſes (as may be ſeen in the *Four* foregoing *Books*) eſpecially for the diſtilling of *Aqua Fort*. I thought it a neceſſary knowledge for every one who ſhall uſe the former works, that he may himſelf purify the *Salt-Petre*, and cleanſe it from the *Earth* of common *Salt*.

3. *How to boyl ſalt Peter.*

Therefore, I ſhall, in this Book, give a large and true

CHAP. II. Instruction to all such (and others who are Lovers of the Products of *Nature*) and tell them of what *Species Salt-Petre* is, and of what 'tis made, also how to *boil* it, so that every one for his own Use may prepare it himself.

Section. 4. *Salt-Petre* is a *Stone-Salt*, which hath in it self a sullen cold fire, therefore for many things serviceable, especially for separations (of which I have written in my Books before) and of great use for making Gun-Pouder from which it cannot well be spared) but 'tis to be made out of many *Sorts* of *Earth*, as hereafter follows.

CHAP. II.

Of what Earth Salt-Petre *is best to be made.*

1. *Sheep stalls.* THE best *Earth* which is richest in *Salt-Petre*, and hath not much *Salt*, is the *Earth* out of *old long-lain Sheep-stalls*, which are very dry and not wet:

2. *Old walls.* The other *Earth* which yields good *Salt-Petre* is the *Calx* or *Clay* of very old *Walls*, in a Town or City: where the *Earth* it self is *Salt-Petrish*, having not stood too wet, nor alwayes dry, but sometimes moistned, and then again shined upon by the *Sun*:

3. *Old Cellers* Next to this is the *Earth* which comes of *broken Chalk-Walls* in ruin'd *Houses*, built upon *vaulted Cellars*, and lain there some years, because the Vapours out of the *Cellar* through the Vault may draw it in, as also ☞ from the daily moistness from above, and so the *Salt-Petre* is generated: and this *Earth* may be dig'd to a good depth, for it lies mixt from above down to the *Vault*, which

which (by the before-mentioned way) may be proved how deep the Earth ſhall be taken for the uſe. Chap. III.

Alſo *Earth* which is *old* (and hath lain long in *unplaſtered* Houſes, Cellars or *Vaults*) is good; but if it lies not above a *Span* or half an *Ell deep*, it is not good to take up, therefore it muſt be try'd; only take Notice, that in thoſe places where you intend to boil *Salt-Petre*, muſt be alſo of *Salt-Petre*, or of a Saltiſh Nature, that they may be workt together. Section. 4. *Unplaſtered Houſes, &c.*

Now, thoſe places in general which lay in good fat and *claiey* Countreys, and the *Earth* of unplaſtered *Horſ-ſtables*, or old *ſheep-houſes* (where the Sun hath power over it) as alſo the *Earth* of *Brewers* and of *Dyers-houſes*, and of all *Alumiſh places*, and the *Aſhes* of *Sope-boylers* and *Tanners*, and all other *Aſhes* (whereof *Lee* is made) are very uſeful, only this latter *Earth*, do's yield much *Salt*: which is ſome hinderance in boyling.

CHAP. III.

How Salt-petre *is to be proved.*

SALT-PETRE and all other ſaltiſh 1.
Earth you muſt prove thus, Put it in a little Tub with water upon it, which may cover it a ſquare hand, let it ſtand two or three hours, then let it run off; and retain the *Lees.*

Then take a little *Ballance* made on purpoſe, pretty 2.
quick in motion, that it may draw a half pound of the proof *weight*, then have two Scales of *Braſs* or *Copper*, ſet in each weigh ſcale one, and in one of them a *Centner* of the Proof weight, and in the other Scale drop with the point of a Knife or a Spoon one drop of this *Lees*

CHAP. III. *Lees* and after that another, until you have weigh'd a Centner of the *Lees*,then with *Pincers* take the *Lees* and the little Scale, which muſt have room for a *Centner* of *Lees* in it) from the Ballance, and ſet it upon a foot made on purpoſe over a little warmth, or upon a piece of Iron-plate or *Lamin*, and hold a large *Candle* under it, and the *Lee* will begin to boil in the little *scale*, and let it boil till all moiſture is boil'd in, and the remains becomes *yellow-white*, and hardiſh, then lift it off, and put it in the Ballance again, lay as much of the proof-weight againſt it as it weighs, ſo you may ſee how much *Salt-Petre* a *Centner* of this *Lee* will yield; only obſerve,

Section. 3. If you make your proof too hot,then the *Salt-petre* will be of a *black-brown*, and ſo ſpoil'd, then make it anew, that the Proof may be right.

4. But that you may know whether it be *Salt-Petre* or *Vitriol*, take with a knife, out of the little Scale, ſome of the reſt of the matter,and lay it upon glowing Coals, and when it melts and burns, and is ſharp upon the tongue and cold, then it is *Salt-Petre*, but if it be *Salt* and no *Salt-Petre*, then it *ſparkles* upon the Coals,and will flow, and is upon the Tongue like a common *ſharp Salt*.

5. By ſuch proof (perform'd with diligence) it doth many times prevent that no unprofitable or *ſaltiſh Earth* is brought in or made to *Lees*, or boyl'd off (as I will ſhew in my following Inſtructions.)

After the Proof is made, obſerve diligently when the *Salt-Peter* doth burn, whether it leaves behind much *fe-ces* or dregs like *Aſhes*, which will not burn, and this is Salt. For, if it be found thus, though the *Earth* be pre-ty rich in the Proof, yet it is not to be accounted ſo good, as if the proof were poorer, and burned clear off upon theCoals, therefore the Salt by it is not ſo good, but it muſt alwayes be ſeparated from the proof, for it weak-

weakens the ſtrong *Lees*, and hinders much in many things, as Experience ſheweth. Chap. III.

But if you have not the Oportunity with the *Ballance* and *Weights*, or underſtand them not, then make a little *Scale* of *Braſs* of a hand-breadth, and put off the *Lee* which is made in it, and ſet it upon a few hot *Coals*, let it boil in, as is above declared, ſo you may ſee whether the *Lee* which is made of the *Earth* be rich of *Salt-petre* or not, which is a nearer way alſo to have the Proof, yet he that knows it by *Ballance* and *weight* is ſureſt of his Reckoning. Section. 6. *Another Proof.*

How the *Salt-Petre* Lee is to be proved, the *Sculpture* following ſhews. 7.

Sculpture XXXVIII.



Deciphered.

1. *The* Tub *in which the* Lee *is to be made, out of which* Salt-Petre *is to be* extracted, *and the* Can *or* Veſſel *to put water into that Tub.*

CHAP. IV. Section.

2. *The lesser* Tub *into which the* Vessel *doth run.*
3. } *The Master with his* Ballance, *by which he proves*
4. } *the goodness of the* Lees *or* Suds.
5. *The* Lamin.
6. *The* Candle.
7. *Pincers.*

CHAP. IV.

How the Lees *or* Suds *shall be made out of the above-mentioned* Earths.

1. *Lee Tubs.*

IF you will make a *Lee* of *Salt-Petre Earth*, then boyl it, if you have a great quantity, and let it be cut open, as deep as it is found good after your Proof, and put it among one another in a dry place, then cause *Tubs* to be made, of the bigness that one may contain 10 *Wheel-barrows* of Earth, so that you may have *Lees* enough, according to the bigness of the boyl-work, or greatness of the *Kettle*; now know that there usually appertains to a common great *boyl-work*, (when the Kettle weighs two Centners of Copper) eight Tubs, set them in such order, that on every side 4. (and so the eight one over against the other) must stand so far from one another, that one with a Wheel-barrow may run betwixt them, and the *Tubs* must stand an half *Ell* high from the ground, and every one shall have a *Tap-hole* below, and on the side, in which may be put a Tap of Wood, to be pulled out, and there must lay below under the *Tubbs* a Channel in which the *Lee* may run together into *Tubs* or *Sinks*, placed in the *ground*, so as the ground may be higher than the tops of the *Tubs*.

2. *Of the reeds or sticks, to be used.*

When the *Tubbs* are set, then lay in every one a bottom of Wood, full of *holes*, which doth not lye up from the

the bottom above two fingers high, and upon the ſame lay a bottom made to it on purpoſe of *Sticks* or *Reeds* (which grows by Rivers or Ditches (bound together a quarter of an Ell thick) but if ſuch ſtuff cannot be had, then put upon the *bottom* full of *holes*, ſome chopt Straw, a ſpan long, and upon the ſame Straw, lay ſmall little *Boards*, that it may remain together, thus the Tubs are prepared, then run the Earth with a Wheel-Barrow into it, and when you can have *old long-layen Tanners* or *Soap-boylers* *Aſhes*, from old holes, put two or three Wheel-barrows full of them below in the bottom, then put the other Earth (which you have proved and brought in alſo upon it) and ſo do untill the Tub be full to a ſpan breadth, then lay it upon an hurdle or frame of *Reeds*, and tye it faſt, and let water be poured upon it (ſo much that it may remain ſtanding a good ſquare hand above the Earth) but if one could have a convenience of letting the Water upon it with a Channel, it were better) and do this ſo long, until the Water may remain a good ſquare hand above the *Earth*, and that it may be poured upon the *Reeds* or *Hurdle*, that no hole may be cauſed in the Earth, but remain even; then let the Water ſtand upon the *Earth* near 8 hours, then let the *Lee* run gently off below through the *Tap-hole*, till it doth run *muddy*, then pour the firſt *Lee* again upon the *Earth*, and ſo do till it runs clear, then run the *Lees* quite off, and retain it, and this *Lees* is called the *Weak-Lees*. CHAP. IV.

3. *Of weak Lee.*

Then pour upon the once *extracted Earth*, common Water again, and let it draw out the other Water, which the firſt Water hath left in the *Earth*, and this that then comes the ſecond time, is the after-Water, and is called watering out, and ſuch *Water* one may uſe inſtead of freſh Water, upon new Earth, and that which runs from it is called *raw Lees* (which is ſtrong enough to boyl) and a Centner made of this common *Earth*, doth uſually contain 3 to

CHAP. IV. Section. 4 pound of *Salt-Petre*, or above, then put the extracted Earth out of the *Tubs* and renew it again constantly, that one may have *Lees* enough to boyl day and night, and need not delay boyling for want of *Lees*.

4. Also there must be set above near the *Kettle*, a *Tub*, out of which may run so much *Lees* into the *Kettle*, as is boyled, that the *Kettle* may remain continually boyling, and always full; then boyl this one day and night, until a *Centner* of *Lee* may be taken out of the *Kettle*, and may contain in the like Proof a quarter of a *Centner*, or 25 pounds of *Salt-Petre*, which may be done in two daies, and one night.

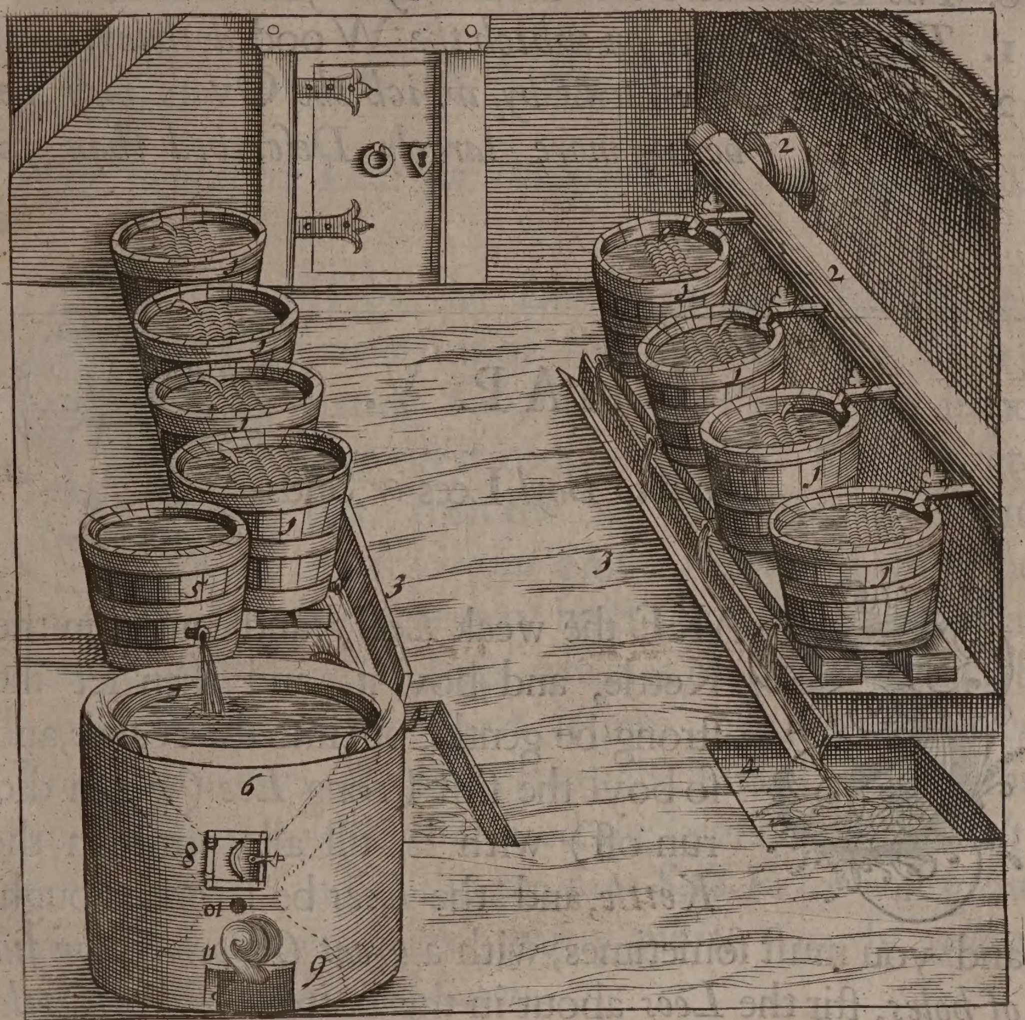
5. Then take two *Tubs* more, prepared with *bottoms* full of *holes* (and the *sticks* or *red bottoms* as aforesaid) only above the stuff must be laid again a bottom full of holes, and put *straw* upon it, and then Ashes of good *Wood* (of the best *Elm*) mingle it together, and moisten it with good warm *Lees*, before it be put into the *Tubs*; then being prepared, put it into the *Tubs*, an *Ell* high above the *straw*, but if you can have the Ashes for a small price, 'twere better to put them together in it, and then pour upon them the boyled *Lees* (containing 25 pound) boyling hot water, let it run gently off, and it will first come muddy, therefore put in more till it run clear.

6. *Strong Lees* When all the *Lees* is gone through both Ashes, which is done that the *Ashes* may take the fatness of the *Lees*, and become fit for washing, and so retain of that which runs first off a part, and put upon the *extracted Ashes*, common hot raw *Lees*, and let the Ashes be watered out with the same *Lees* which goes the second time through the Ashes, and is called strong *Lees*, then water it out the third time with hot *Lees* (and this is called weak *Lees*) after this the Ashes may be watered out with common Lees, untill the strength comes out of it.

By

By the following Sculpture *you are taught how the Tubs are to be ſet, and the* Lees *made and boyld from it.* CHAP. IV.

Sculpture XXXIX.



Deciphered.

1. *The eight* Tubs *into which the* Petre-Earth *is to be put.*
2. *The Pipe with a* Braſs Cock, *by which the Water is let into the eight* Tubs.
3. *The* Channel *by which the* Lees *falls from each* Tub, *and ſo into the* Receiver.
4. *The* Sink *or great* Receiver *of the* Lees.
5. *The ninth* Tub, *from which the* Lees *runs into the* Kettle.
6. *The* Oven *wherein the* Kettle *ſtands.*
7. *The* Kettle *on the top of the* Oven.

CHAP. V.

8. *The* Iron Door *by which the* Wood *is to be put into the* Oven *under the* Kettle.
9. *The* Wind-hole *in the bottom of the* Oven.
10. *The* Hole *where the* Oven *may be seen into.*
11. *The* Iron Grate *on which the* Wood *doth lay.*
12. *The form of the* Door *by which the* Oven *may be lookt into (being more largely Described than in* Fig. 10.)

CHAP. V.

How to Boyl Lees *or* Suds.

TAKE the weak *Lees*, and put it in the Kettle, and boyl it, and then let the strong be gently put into the *Kettle*, and so boyl the first strong *Lee* (which did run off) with it, till all comes in the *Kettle*, and the *Lees* be strong enough, and you must sometimes, with a *great Copper-Spoon full of holes*, stir the *Lees* about in the bottom of the *Kettle*, (for when the *Lee* yeilds Salt it will fall on the bottom of the *Kettle*) then lift it out with the great *Ladle*, and always take the *scum* from it, then prove the strong *Lee* by droping one, two or three drops upon a *cold Iron*, and when the *drops* stand upon it like *Butter* (that is, when they flow not off, when you turn the *Iron*) then the *Lees* is strong enough, or set the *Lees* in a little Copper *Vessel*, upon cold water, till it becomes cold, then the raw *Salt-Petre* will show it self, whereby you may see alwayes whether the *Lee* be strong enough, which may be seen also upon the great *Spoon*, wherewith you *scum* it, for if the *Lees* draw it self into a Body like an *Oyl*, the proofs

proofs are right, now when the *Lee* is thus prepared, then a hundred pound of it will contain in the proof, very near ſeventy pound of *Salt-Petre.* CHAP. VI.

CHAP. VI.

How to prepare Lees *for the crude and raw* Salt-Petre.

WHEN the *Lee* is prepared (as above) put it out of the *Kettle*, into a very ſtrong *Tub*, of good *Wood*, let it ſtand in it till it cool a little and the dirt ſettles, then the Salt will faſten it ſelf in great *Grains* on the *Wood*, and when the *Lees* is cool, ſo that you may hold your finger in it, then draw it off through a Tap, which is to ſtand a ſpan high from the bottom, and put it into great deep *Wooden* Troughs, or into *Copper Kettles*, which muſt ſtand in the ground, (the colder they ſtand the better) till the *Salt-Petre* grows, and in this the raw *Salt-Petre* will grow almoſt two fingers thick, partly *white*, partly *yellow*, and partly very *black-brown.* Section. 1.

When the *Lee* hath ſtood in the growth two daies and two nights, draw off the *Lee* from the *Salt-Petre*, and put it the ſecond time over *Aſhes* again with other ſtrong *Lee*, elſe it will be too fat and will not grow, but when the *Aſhes* are not good, (ſo that the *Lee* cannot grow) then put ſtrong *Lee* with other *Lee*, over new good *Aſhes*, and boyl it again to grow (as above:) likewiſe when the ſtrong *Lee* in the making is very muddy in the *Kettle*, and the *Salt* cannot fall becauſe of the *muddyneſs*, if this happen, then only take out the *Lee* to the growth, and let the remaining Lee, purify through the Aſhes.

Now

CHAP. VI.

Now how the Salt is to be taken out, and how the ſtrong Lee *ſtands growing, this following* Sculpture *will ſhew.*

Sculpture XL.



Deciphered.

1. *The long narrow* Tubs *wherein to cool the* Lees.
2. *The* Oven *wherein the* Kettle *is placed.*
3. *The* Maſter *that makes and takes out the* Petre, *and puts it into* ſeparating Baskets.
3. *The* ſeparating Baskets.
4. *The* Tub *out of which the ſtrong* Lee *runs into the* Kettle.
5. *The* Melters *in which the* Salt-Petre *Improves.*
6. *The four* Kettles *ſtanding in the Ground wherein the* Salt-Petre *alſo* improves *it ſelf.*

7. *A strong* Tub *into which the* Salt-Petre *is to be cast* *as it* improves. CHAP. VII.

CHAP. VII.

How to purify *and cleanse the* raw Salt-Petre.

WHEN the *Salt-Petre* is thus made, and the rest of the *Lees* drawn off, lift up the *Kettles* or *Trays*, and turn them to one end, that the remaining *Lee* may run clear off; then take a great *Iron Spoon* such as *Bricklayers* use, and lift out the *Salt-Petre* with it, out of the *Kettles* or *Trays*, put it into a Tub, with a *hole* below, that the *Lees* may run clean off. Section. 1. *Raw Salt-Petre.*

Some *Salt-Petre Boylers*, (who sell the raw unpurified *Earth-Petre*) they pour clean Well-Water upon it, that it may be well washed from the most part of its *redness*, and become *white*, what is run off they put again to other strong *Lee*, and boyl it the next boyling. 2.

But if you will *purify* the *raw Salt-Petre* right and well from its *salt* and *uncleanness*, to become fair and white, do it thus; When the *raw Salt-Petre* is a *Centner* or four, cause the purifying *Kettle* to be cleansed and dryed, pour in it so much Well-Water, that the *Salt-Petre* may be dissolved in it, then make a fire under it, let the water be boyling hot, and then put the *Salt-Petre* gently and easily in it, and turn it about with the *scumming Spoon*, that the *Salt-Petre* may be the sooner and easier dissolved. 3. *To purify it*

But while you are pouring it into the *Kettle*, let there be but little fire under, that the cleansing may remain warm, and when the *Salt Petre* is almost all put into the 4.

CHAP. VII.

ter and melted, and the cleanſing begin to boyl, then with the *ſcumming-Spoon*, put ſome upon the ground, and when the *Salt-Petre* hath ſet great *Grains* of Salt, then lift it out, which is better for it.

Section. 3. *To make proofs.*

When this is done, and the cleanſing begins to boyl, then it brings up a *black ſcum*, take that off, and take a *Copper* Veſſel which holds near 8 *Loths* of ſtrong *Lees*, and make it half full of the cleanſing; put it in cold water to cool it ſuddenly, ſo the *Salt-Petre* will begin to *ſhoot* (and this is called a *Proof* made) then you will ſee whether the cleanſing be yet too ſtrong, if it be, there will come a *skin* over the Proof in the Veſſel, and if ſo, then fill more warm water into the *Kettle*, and keep it in ſuch a ſtrength, that the cleanſing in the *Kettle* may *bubble*, then make a Proof out of the Veſſel, and when the cleanſing ſhoots in it, and in the midſt do remain open (ſo that it doth not cloſe together) then the Proof is right, but if it grows together, then fill more water, till the Proof remain open, and pour near a pint of Vinegar in the cleanſing into the *Kettle*, which will bring up a black *ſcum*, for the cleanſing will purify it ſelf of it, and when the ſcum is thick, take it off, and when the cleanſing hath *bubled* a while longer, pour in it ſo much good *Vinegar* as may keep it in continual *bubling*, and then take the *black* off, as at firſt, this you may do the third time, and pour on *Vinegar*, till the cleanſing be very clean, and do caſt up no more *black ſcum*; Then take 3 or 4 *loths* of *burnt-Allum*, beaten ſmall, and put it in the cleanſed water, ſtir it about, and of this the *Salt-Petre* uſeth to yield fine long *flacks*, and it hurts not the *Salt-Petre*, then pour the cleanſing in the before-mentioned high *ſlender Tub*, and cover it, that it be not cold in the *Tub*; let it ſtand an hour or two at moſt, thus the *yellow dirt* will ſettle it ſelf in the bottom, then let the cleanſing run out while 'tis hot, and pour it into a great *wooden Tray*, or great *Cop-*

To purify it again.

Copper Kettle, which for coolneſs had need ſtand in the ground, and cover them warm that the *Lees* may begin to ſpring from below, elſe the *Salt-Petre* will grow firſt above and fall down, and ſo will not yield very long *ſlacks*, let it ſtand three or four days until it grows no more, which you may prove thus; ſet ſome of the *Lees* in the *Copper-proof Veſſels*, if it grow no more in it, then take away the reſt of the *Lees*, and let it clean go off, and then put the *Salt-Petre* with the *Iron Spoon*, clean out of it, into a *Veſſel* with a hole below, that the reſt of the *Lees* may run off, and thus you have purified *Salt Petre*. CHAP. VII.

The *Lees* which is drawn off (while it is yet *ſalty*) boyl it as the other ſtrong *Lee* (in making of the *Salt* or *Lee*) and from this the *raw Salt-Petre* will grow very well. But ſome uſe at the cleanſing in the *Kettle*, *Calx viva*, by which it becoms as *white* as Milk, and they let it ſettle in the Tub, which makes the *Salt-Petre* very fine, but it ſettles not ſo ſoon or ſo well in the Tub, and while the cleanſing ſtands thus ſtrong in the *Kettle*, you muſt not make too great a fire, for if it boyl too high, you can hardly quiet it, or hinder it from running over, whereby comes great loſs, therefore it muſt be kept *bubling* with a little flame, and when the *Kettle* is waſhed, ſuch water is to be boyled again with the ſtrong *Suds* or *Lees*, but the *ſcum* which is to be taken off from the cleanſing muſt be put upon the *Aſhes*, where more *Lee* is to be put over *Aſhes*, that that which is yet in it may come to profit, and when you boyl much in the *Kettle*, then lay upon it a *hard grey ſtone*, like the colour of *Tartar*, under which the *Kittle* uſeth to burn, and this is ſometimes to be cleanſed and ſeparated off, with a flaming fire made under it, to make it fly off, and when the *Kettle* is empty and clean, then you may boyl it again. 4.

The *Earth* and *Aſhes* which have been extracted (whereof comes the *raw weak Lee*,) are to be put in heaps 5.

CHAP. VII. into *vaults* or Houſes, and in four years it will be fit to uſe, only when you uſe it to make *Lees*, then you muſt (many weeks before) dig open ſuch *Vaults*, that the moiſtneſs may go off, and the Sun may ſhine in, and of this good *Lees* may be made.

Section. 6. *How Salt-Peter is generated and ſpoiled.*

But the old *Maſters* do ſuppoſe, that if one could run off the *Petre* in the Houſes under Tylings, it would be ſooner good, which is likely; for, becauſe of too much moiſtneſs or daily rain upon it, the *Salt-Petre* is much ſpoiled, and will have only a little moiſtneſs, of which it is to be generated.

7. *To mingle ſplinters of Wood with it.*

Alſo ſome of the old *Maſters* do uſe among the Earth in the *Lees*-Tub, to mingle bits of *Firr Wood*, a finger long, and theſe they put among the Earth, with the *Lees* that hath been made, and ſet it in the *vaults* or *Houſes*, and ſuch fatneſs which is uſed in the mingling the *Salt-Petre* doth alſo generate and multiply, and they ſay when ☞ it lays in a dry place, it may be uſed again within a year; likewiſe they pour upon the light poor *Earth* in *Houſes*, the *old decayed colours* of *Cloth-Makers* or *Dyers*, or any ſharp *decayed colours* of Waters made with *Allum*, yet not ſo often, but that ſuch Earth may have a better beginning to a good effect. Next, they bring alſo *Soot* out of the *Stoves*, *Furnaces* and *Chimnies*, and mixt with the Earth, likewiſe the Aſhes of ſuch *Lees* as is made in Houſes, and in the Noſel or Mouths of Ovens, where much Straw is burnt, which Ingredients do much help to a *melioration*, that it may ſooner be uſed.

8. Know this only by the way, That ſometimes Earth is found which gives *brown* thick *Lees*, which of it ſelf is too fat to make *Salt-Petre* of, amongſt which you muſt mingle another Earth more brittle and lean, and with it put ſome made *Lee* over it, or elſe you will bring no *Salt-Petre* off from it fit to be waſhed.

How the *Salt Peter* is cleanſed, and what Inſtruments per-

pertain to it, they are almoſt alike to the XXXIX. and XL. *Sculptures* next before, and out of the ſame to be ſeen. CHAP. VIII.

CHAP. VIII.

How to cleanſe *the* great Graind *and black* Salt-Petre *Salt.*

THE *black* or *grey Salt-Petre* Salt, which is found (in boyling *Salt-petre*) below in the *Kettle* and *ſlender-Tub*, this may be good *Salt* for dreſſing *Victuals*, without any danger, only it muſt firſt be cleanſed and purified thus: Waſh well the *Kettle*, put in clean Well-Water, make under it a fire, and when it begins to boyl, take the ſaid *Salt*, put it gently in, and let it diſſolve, ſtir it continually, and when 'tis all diſſolved, then pour the *Lees* into a *Tub*, let it ſettle that the *Lees* may be clear, then waſh the *Kettle* clean again, put the clear *Lees* or *Suds* in it, and boyl it till the Salt fall in it, and then lift it out with the great *Spoon*, put it in a *Basket* above the *Kettle*, that the remaining *Lees* may run again into the *Kettle*, and lift up ſuch *Salt*, untill no more will fall, then dry it, and ſo it is prepared: But ſome before they uſe it, let the *Salt* glow out, by which it becomes ſtronger, and what remains of the *Lees* in the *Kettle*, boyl it like the other Suds to a *Lees*, and put it out, and let the *Salt-Petre* grow out of it, for this Salt coming out of *Salt-Petre*, cannot be quite without *Salt-Petre*, but there will be ſtill ſome among it, which is to be cleanſed off thus. Section. 1. *The uſes of it.*

Take Notice if the Salt have too much *Salt-Petre*, or be very *black* and unclean, the Salt will not become very *white* at once, for when the *Lees* begins to be ſtrong, then 2. *To make it white.*

CHAP. IX. ascends not *white*, therefore such unclean *Salt* must be dissolved in the *Kettle* once more, purified and cleansed, and then it will become very white.

Section. 3. *To purify the Salt through Ashes.* There is another way of cleansing such *black* and unclean Salt, *viz.* one may put the dissolved Salt out of the *Kettle* thus warm, through the *Ashes*, over which already *Lees* hath been put, of which the *salt Lees*, will almost purify and cleanse it self, yet it becomes not all *white* Salt, but the last remains commonly *yellow*, therefore it must be cleansed once more; likewise take notice, that when the *Salt* is to be put over the *Ashes*, that it must be well watered out, that the *red* bottom may not be very *salty*, else it will come in the next strong *Lees*, and makes it very *salt*.

And thus you have a true large Instruction of the *Salt-Peter boyling*, how it is to be usually observed; but it is a tedious and not profitable boyling for this reason, because there is in a *Centner* of *Lees* but three or four pounds of *Salt Petre*, therefore the Water remaining must all be boyled off, which takes much time and expences, and cannot be avoided, but how it may be helped (as I my self have found out and used) I will Demonstrate in the next Chapters.

CHAP. IX.

How to make the raw Lees richer *before the* boyling.

1. *The manner of doing it.* AFTER this way many *Salt Peter boylers* have searched, but the true Method (because they have not been guided by the *little Proof*) they could not find; but thus it is to be done. Take a Tub full of the *Lees* (of which a *Centner* con-

contains four pound of *Salt-Petre*) pour it upon new *Earth*, let it ſtand upon it near 12 houres, that it may run off and as much as remains behind of the *Lees*, ſo much Water pour upon the Earth, and let it run through to the other, and thus you will receive ſo much again, as you had of *Lees* before; now when this is done, then prove the *Lees*, through the *little Proof*, ſo you will find (becauſe of the other pouring over) it will contain 6 pounds, this 6 pounds of *Lees*, prove again upon freſh *Earth*, and let it ſtand 6 hours, and then run it off, and follow it with ſo much Water as remains behind upon the *Earth*; alſo that the firſt meaſure of Lees may come only again and not more, then the Lee will contain nine pounds, this you may once more pour over *freſh Earth*, and enrich it; but always obſerve, that the Lees may be neither more or leſs then it was at the firſt; and to follow this with Water in this manner, I only mention for the proof ſake, that one may be ſure of the enriching, for the Lees by this means will contain more *Salt-Petre*, and yet the *Lees* will not increaſe; then to ſupply the firſt meaſure of *Lees*, pour in ſome of the *weak* Lees, ſo it will be the ſooner and more enriched, and of ſuch you may then ſoon come to a Suds. CHAP. IX.

And though there is much labour and dilligence thus to enrich the Lees, yet it comes all again, for one may make in one Week two or three times more *Salt-Petre*, and it ſpends no more Wood, only it requires more *Veſſels* to keep the *Lees* ſeverally for their enriching. Section. 2. *The profit.*

I will alſo ſhew hovv the *Salt-Petre boyling* may be ordered to profit, firſt obſerve, becauſe there appertains much of *Earth* to a great *Boyl-work*, and good *Earth* is not alvvays to be had, but ſometimes, if one cannot prove the *Earth*, very poor *Earth* is mingled amongſt it, that the expences are ſpent upon the poor as the good, and thereby no gain to be expected, therefore I judge it 3.

more

CHAP. IX. more profitable to make the *Boyl-work* vvith three or four *Tubs*, that one may take the beſt *Earth* which is to be had out of old *Cities*, *Houſes* and *Stables*, yet not too deep, by vvhich means ſuch *Lees* as are of 8 pounds content, may eaſily be enriched (as above) to 18 or 20 pounds, and not done vvith ſo much boyling, this they may conſider of, eſpecially vvhere Wood is dear.

4. *To water out the Earth.* When the Lees is thus enriched, there vvill remain more *Salt-Petre* in the *Earth* (for the good Lees cannot take it all out) then upon this Earth pour common water, let it ſtand ſome hours and then run it off, ſo you will receive weak Lees, prove it, and make the enriching thus, as hath been ſhewed, and ſo you may be continually at your work.

5. *To enrich Lees of Allum.* Now becauſe the *Salt-Petre* Lees may be enriched out of poor Earth (much more the *Allum* Lees out of the ſame Oar and Earth) and may be boyled to better profit, vvill by dilligent ſearching, be found hovv it may be performed.

6. *Salts of Oars.* After this manner I judge one may make Lees on all *roaſted Oars*, and try vvhat *Salt* they may yield, for I do believe that the *roaſted Lead Oars* are not vvithout ſuch a ſalty matter, which I leave to farther Experience; But how a *Salt-Petre* Halls, Houſes or Sheds, are ſeen to be on the out-ſides, you will ſee in the following Sculpture, thus

Deciphered.

1. *The* fore-part *of the* Salt-Petre Houſe, *wherein the* Lee Tubs *do ſtand.*
2. *The* back part *wherein the* Kettle *and the* Oven *do ſtand, wherein the* Salt-Petre *is to be* boyled.
3. *The* Old Pieces *of* dig'd Earth, *out of which* Salt-Petre *is to be taken.*
4. *The* Wood *uſed for boyling it.*

5. *The*

5. *The* Servant *that shaves and fits the pieces of* Earth, *for* boyling, 5. 5. 5. Chap. IX.

Sculpture XLI.



It is also to be observed, That the *Salt-Petre Sheds* must be built very low, as possible, and covered with *Straw*, whereby the warmth from the *Kettle* may go over the *Tubs*, especially in Winter, (if Earth is to be had for boyling) so that the weak *Lees* may not freeze.

CHAP. XI.

CHAP. X.

How Flints *are to be proved for* Vitriol, *and* Allum-Oar *for* Allum.

Section. 1. *To make* Lees *of it.*

FIRST you must observe, that all *Flints* are *Coppery* or *Vitriolish*, and some more rich than others, the proof is thus; Roast the *Flint* very well, cool it, beat it small and make *Lees* of it, then weigh a *Cent-ner* of it, and prove it, (as is said of the *Salt-Petre Lees*) and what remains in the little *scale*, weigh against the *weight*, then you may find how rich the *Flint* is: But that you may be sure it is *Vitriol*, try such proof upon your *Tongue*, if it be *sharp* and *sowr*, and gives a *redness* to clear *Iron*, then the *Vitriol* is good, but when the proof doth not so, then make more *Lees*, and try it in a little pan of *Lead*, that you may know what kind of *species* it doth yield.

2. Many think that because we make *Vitriol-Lees* out of *Roast-Oars* and *Copper-Stone*, therefore we may out of *Copper* and *Silver*, &c. which is with good profit to be melted out of them, yet 'tis found, that out of the same *Flint*, and *Copper-stone*, made into *Lees*, there hath been made much less Copper than when it had been melted before the making them into *Lees*, by reason the *Vitriol Lees* which is made of it, hath drawn out the most part of the Copper, and somewhat of the Silver, therefore it is not to be trusted to, nor any account to be made of it.

3. *Proof upon Allum.* But the *Allum-Earth* or *Shiffer*, if you prove it for *Allum*, it matters not that it be *roasted*, neither can it be done *raw* with it, as it comes out of the *Vein*, but it must lay

lay a while upon a heap together, to be weathered and warm'd in it ſelf, that it may fall aſunder and break out, and then you may make *Lees* of it, and you will find by the proof of the *Allum* upon the *Tongue*, that it draws it together very *Vitrioliſh*. CHAP. X.

Further, we may obſerve, that in the *Vitriol-Mines* (as at *Goſlar* upon *Cuttemburg*, and other places) that the Waters which by Art are drawn out of the deepeſt Mines are for the moſt part vitrioliſh, yet ſome more than others, and if ſuch Water might be directed in wooden *Pipes* into the *Boyling-Work*, and boyl'd for *Vitriol*, it would yield good profit; yet when this is done, you muſt take heed that no ſweet-Water (which by Arts is brought into the Mines or other Tiling Water,) may come among it, but ſuch Waters (as above) you may prove, and further after your pleaſure make profit by them. Alſo on this wiſe you may prove all Wells or Springs of *Salt* (after the beforementioned little proof) and ſearch and know properly how rich they be. 4. *Vitrioliſh Water in the Mines.*

And I was willing to mention theſe Inſtructions, for *ſalty-Proofs*, that thoſe who are now concerned, may know how the better to manage them. 5.

Thus much, loving *Reader*, I have writ of proving all ſorts of *Oars* and *Mettals*, and other neceſſary things fit to be known, for *proving* and *meltiug* them, to the good and profit of all *Mine-workers* and *young Aſſayers*, and for ſuch as are ignorant of theſe Arts: and this I have done in five Books, moſt faithfully and dilligently, and alſo given very large Inſtructions, by writing and Sculpturing the ſame; and I deſire for this time that every one who loves or inclines to theſe Sciences, will be content with it, and accept of my good Intentions, for theſe are not deſigned for *Magiſterial Artiſts*. 6.

Now

CHAP. X. Now in these *Books* I have not undertaken to treat of all *Oars* singly, upon preparing and melting them in the great Works, because I could not well discharge my self therein, in respect that it would be a greater Task than my present Services can admit of, yet I will reserve it to a farther Opportunity, and I will also respite my Labour to discover how the Gold and Silver upon the Coyn'd Works are to be ordered, upon diverse certain Contents, and so made to profit, which would require a particular and more large Volumn, considering that it is a great Work and for many years (with other things pertaining to the Coyn'd-Works) have been as Secrets, and therefore I will also let them be as Secrets for the present.

Section. 7. And although *Goldsmiths*, common *Assayers* and *Merchants*, do suppose when they can reckon some dressings of the *Crucible*, they have the perfect Art, yet they want the most needful and best parts; namely, they have not been with the *Coiners*, neither have they any true understanding or exercise of it, and therefore in these matters nothing could be done with fruit or profit.

8. Now concerning the *Generation* of *Oars* and *Metals*, of which the *Philosophers* and *Naturalists* have wrote and disputed very much, I leave all of them to others with their Rules and Opinions of the *Mine-Workers*, by reason that their thoughts and presumptions, are not only uncertain, but oft-times wide and agree not together; yet I really believe, That God the *Almighty Creator* hath reserved these *Mysteries* to his *Almightyness*, and that *Gold*, *Silver* and all *Metals* through his Everlasting *Word*, the *Son of God* (from whom *Heaven* and *Earth*, and all things which are in them have their *Creation* and *Being*) are to this day preserved and multiplied, and that the knowledge of them are come to clear light, and published for his Glory and the good of *Mankind*; for which

which glorious Guifts, every one ought with pure *Zeal* to praise and thank God from his Heart, and imploy all his dilligence and reason, so that what he may have out of the *Mine-Works* may be used to the praise of *God*, and to the *profit*, *help* and *advantage* of his *Neighbors*, whereby *God* the *Almighty* will not only bless it, but also *richly Multiply* the *Possessors* of it, and cause them to injoy it to the *Salvation* of their *Souls*. CHAP. X.

Now, may the Lord God, Creator *and* Preserver *of all* Creatures, *be graciously pleased to open the hidden Treasures of the* rich Gold Sope, *also of* Gold, Silver *and all* Metallick Veins, *for upholding the Posterity of the Poor Sons of* Adam, *and by blessings and long continuance, preserve them for his beloved Son, our* Lord Jesus Christs *sake, and that we may use them with thanks and praise.* Amen.

FINIS.

Fleta Minor,

Spagyrick LAWS,

The Second Part.

CONTAINING

ESSAYS ON Metallick WORDS:

Alphabetically composed, as a DICTIONARY TO

Lazarus Erckern.

Illustrated with two *Sculptures*.

By Sir *John Pettus*, of *Suffolk*, Knight.

Scire tuum nihil est;
Nisi te scire, hoc sciet alter.

LONDON,
Printed, for the Author, by *Thomas Dawks*, his Majesty's *British* Printer, at the West-end of *Thames*-street. 1683.

Kind Reader,

YOU are desired to take notice, That all the following words are only transciently used in the Essays, and therefore referr'd to the Capitals of the Dictionary, and the Capitals of the Dictionary are referr'd to some parts of the five Books of Erckern.

Adam *vide Gold.*
Ægipt *v. Gold.*
Ægiptians *v. Quick-silver.*
Æthiopia *v. Gold.*
Æs *v. Brass.*
Ætna *v. Bitumen.*
Affrica, *v. Gold.*
Alabaster, *v. Marble, Plaster.*
All *v. Chimistry.*
Allays *v. Mony.*
Allum *v. Minerals.*
Almonds *v. Blanch.*
Alpha *v. Regulus.*
Amethist *v. Metals.*
Antimony *v. Metals, Minerals.*
Antartick *v. Gold, Loadstone.*
Antidotes *v. Dung.*
Architecture *v. Calcine.*
Armoniack *v. Minerals.*
Aarons Bells *v. Bell.*
Arsenick *v. Mineral.*
Artick *v. Gold, Loadstone.*
Ashes *v. Gold, Pulveration.*
Asses *v. Bone.*
Asia *v. Gold.*
Atlantick *v. Gold.*
Auricalcum *v. Wire.*
Barly corn *v. Measures, Money.*
Barme *v. Yeast.*
Bees *v. Putrefaction, Regulus.*
Beergood *v. Test.*
Beer *v. Blink.*
Black Lead *v. Lead.*
Blood *v. Gold.*
Blood-stone *v. Polish.*
Boards *v.* Planks.
Boar *v. Bacon.*
Borneo flu. *v. Gold.*
Botanist *v. Colour.*
Bread *v. Feces.*
Brimstone *v. Minerals.*
Bullock *v Ox.*
Buxtons Wells *v. Mines.*
Calcanthum *v. Sublimatum.*
Calaminaris *v. Brass, Mineral.*
Camelion *v. Eggs.*
Camel *v. Armoniack.*
Capa longa fish *v. Conglutinate.*

Cedar *v. Gold.*
Ceruſe *v. Lead.*
Chaldeans *v. Quick-ſilver.*
Chalck-ſtone, *v. Lead, Lime.*
China earth, *v. Earth.*
Chiromancy *v. Meaſures.*
Cinders *v. Coal.*
Cinnabar *v. Minerals, Quick-ſilver.*
Clay *v. Loadſtone.*
Cloath *v. Filtration.*
Coaches *v. Yellow.*
Coin *v. Mint, Mony.*
Conſonants *v. Regulus.*
Conſtellations *v. Loadſtone.*
Copper *v. Metal.*
Corroſion *v. Calcine.*
Counterfeits *v. Mony.*
Chriſt *v. Gold.*
Crocus *v. Verdigreaſe.*
Cubit *v. Meaſures.*
Cup *v. Pipkin.*
Damp *v. Evaporation, Mines.*
David *v. Gold.*
Dew *v. Feces.*
Diamonds *v. Metal, pulveration.*
Diſcourſes *v. Regulus.*
Devils arſe *v. Mines.*
Dodmans *v. conglutinate.*
Dogs *v. Dung.*
Dovegang *v. Mines.*
Dram *v. Meaſures.*
Ducks *v. Dung.*
Dung *v. Eggs, Gold.*
Durdans *v. Petrefaction.*
Duſt *v. Pulveration.*
Earthquake *v. Boyling.*
Ebb *v. Loadſtone.*
Eden *v. Gold.*
Eels *v. Putrefaction.*
Eldon hole *v. Mines.*
Electrum *v. Metals.*
Elbow *v. Meaſures.*
Ell *v. Meaſures.*
Elephant *v. Armoniack and Dragons Blood.*
England *v. Load-ſtone; Water-ſtones,* &c.
Engliſh Mines, *v. Mines.*
Equinoctial v. *Gold.*
Erckern, Etimology v. *Alchimiſt.*
Eſſays v. *Aſſay.*
Europe v. *Gold.*
Eye v. *Needle.*
Fathom v. *Meaſures.*
Fermentation v. *Teſt.*
Finger *v. Gold.*
Fiſh *v. Eggs.*
Flax *v. Flux.*
Fleſh *v. Gold.*
Flowing *v. Loadſtone.*
Flower *v. Fermentation, Teſt.*
Flies *v. Putrifaction.*
Fort *v. Meaſures.*
Foam *v. Teſt.*
Frankincenſe *v. Xiphion.*
Froth *v. Litarge, Teſt.*

Fullers-earth, v. *Earth*
Fusile, v. *Fusion.*
Gallenist, v. *Quick silver*
Ganges, v. *Gold*
Geese, v. *Dung.*
Gems, v. *Colours, Metals*
German Mines, v. *Mines*
God, v. *Gold, Regulus*
Goldsmiths, v. *Gold.*
Gold, v. *Metals*
God's-good, v. *Yest.*
Gums, v. *Yellow*
Gunpowder v. *Boyling, Pulveration.*
Guts v. *Bells*
Guenea v. *Gold*
Hards v. *Flocks*
Havilah v. *Gold*
Heaven, Hebrews, Hell } v. *Quicksilver*
Herrings, v. *Ashes*
Hens v. *Eggs.*
Hides v. *Bellows*
Hisperides, v. *Gold*
Holy Ghost v. *Regulus*
Hony-Comb v. *Putrefaction*
Horse v. *Dung.*
Hungary v. *Mines*
Iclingham v. *Earth*
Idols v. *Dung*
Jesus v. *Gold*
Inch v. *Meeasures*
India v. *Gold.*
Industry v. *Alchimist*
Ink, v. *Copperas*
Iron v. *Metals, Oars.*
Ising-glass fish v. *Conglutinate*
Isop, v. *Gold*
Ivory, v. *Black.*
King v. *Regulus.*
Lapis celestis v. *Vitriol.*
Lead v. *Metals. Oars.*
Leather v. *Expression.*
Lees, v. *Pulveration.*
Leimster v. *Flocks*
Lethargy v. *Littarg*
Letters 24 v. *Regulus*
Leven v. *Firmentation.*
Limbus patrum, Limbus Infantium } v. *Quick-silver.*
Limpet fish v. *Conglutinate*
Linnen v. *Expression*
Linsy woolsy v. *Timode*
Linseed-Oyl v. *Oyls*
Liquid v. *Regulus*
Litturgy v. *Littarge*
Loadstone v. *Gold*
Lombardy v. *Gold*
Luna v. *Quick silver*
Magnas, Magnes, Magnus, Magnetism } v. *Loadstone*
Mediterranean v. *Gold.*
Mendip v. *Mines*
Menstruum v. *Extraction*
Mice v. *Putrefaction*
Mercury v. *Quick silver*
Miles v. *Measure : Quicksilver*
Mill-stones v. *Quarry*

Mines Royal v. *Copper.*
Mine-Counties, and no Mine-Counties v. *Mines*
Miniature v. *Colours.*
Minium } v. *Quick-silver.*
Moon }
Money *v.* *Coin*
Mortar *v.* *Earth.*
Moses *v.* *Gold.*
Musick Instruments v. *Bells.*
Mutes *v.* *Regulus.*
Nails }
Navigation } *v.* *Loadstone.*
Needle }
Nigro Fl. } *v.* *Gold.*
Nilus }
Nitre *v.* *Minerals.*
Norwich v. *Boyling.*
North v. *Petrefaction.*
Oakers v. *Arsnick.* *Earth.*
Obedience see *Regulus.*
Officers v. *Alchimist. Mint.*
Oky hole see *Petrifaction.*
Onion see *Loadstone.*
Os Oris, Os Ossis see *Bone.*
Orpiment see *Minerals.*
Ox see *Dragons blood.*
Oysters see *conglutinate.*
Palm see *Measures.*
Palmistry see *Measures.*
Paper see *Filtration.*
Paradice see *Gold.*
Peat see *Turfe.*
Peacock see *Dung.*
Pencils see *Coal.*
Pint see *Measures*
Pison see *Gold.*
Planks see *Planks.*
Planets see *Colours.*
Plant see *Loadstone.*
Plate see *Silver.*
Pliers see *Pincers.*
Plawing see *Boyling.*
Plimouth see *Calcine.*
Poland see *Mines.*
Policy see *Polish.*
Pools Hole see *Putrefaction.*
Pound see *Weight.*
Pouder of Projection see *Alchimist, dulcification, Flowers. pulveration.*
Prayer see *Gold.*
Priest see *Gold.*
Pugil see *Measures.*
Purification see *Gold.*
Putte see *Polish.*
Quenching see *Steel.*
Quicksilver see *Gold, Metals, Pulveration.*
Ratsbane see *Arsenick.*
Reason see *Ground.*
Rebeckah see *Gold.*
Red Lead see *Lead.*
Religion see *Gold.*
Resurrection see *Calcine, Gold, Pulveration, Dust, Ashes, Quick-silver.*
Riddle see *Rattar,*
Rising see *Test,*
Runt see *Ox,*

Sa-

Sables see *Sands*.
Sand see *Earth, Russet*.
Saphire see *Metals*.
Sandiver see *Minerals*.
Scarlet see *Gold*.
Scurf see *Scales*.
Scruple see *Measures*.
Screen see *Rattar*.
Seeve see *Rattar*.
Sentences see *Regulus*.
Separation see *Cement*.
Shafts see *Mines*.
Sheppy Island see *Copperas*.
Sillables see *Regulus*.
Silver see *Metals*.
Sinoper see *Armoniack*.
Skin see *Gold*.
Smerna-soap see *Bacon*.
Snails see *conglutinate, Putrefaction*.
Sodom see *Bitumen*.
Sods see *Turf*.
Snakes see *Egg*.
Solomon see *Gold*.
Soul see *Loadstone*.
Span see *Measures*.
Speckled see *Missy*.
Spittle see *Flegm*.
Spring see *Salt*.
Stanneries see *Tin*.
Sterling money see *Money*.
Steer see *Ox*.
Stibium see *Minerals*.
Stills little see *Limbeck*.
Stones see *Petrefaction*.
Sublimation see *Fixation*.
Sugar see *Dulcification*
Sulphur see *Flegm, Minerals*.
Tabacco pipe see *Coal*.
Talck see *Minerals, Plaster*.
Teasle tree see *Petrefaction*.
Terrella see *Loadstone*.
Terra Sigillata, Lemnia, Arminia see *Earth*.
Testis *v. Test*.
Thane see *Athanor*.
Thumb see *Measures*.
Thummim see *Alchimist*.
Tide-Well see *Boyling*.
Tin see *Metals*.
Tongs see *Pincers*.
Touch-stone see *Marble; Needle*.
Travelling see *Money*.
Tree of Life, of good and ill see *Alchimist, Gamahez*.
Truth see *Ballance*.
Variation see *Load-stone*.
Venice see *Mines*.
Venus see *Quick-silver*.
Vermilion see *Quick-silver*.
Virgula Divina see *Xanthus*.
Vitriol see *Flegm*.
Visuvius see *Bitumen*.
Vitriol see *Minerals*.
Union see *Cement*.
Vowel see *Regulus*.
Vows see *Regulus*.
Urine see *Alchimist*.
Wales see *Mines*.

Water ſee *Gold.*
Wax ſee *Plaster.*
Weapon ſalve ſee *Bacon.*
Weather ſee *Load-stone.*
Wells, *v.* Boyling, Mines, Wheel,
Wheat ſee *Meaſures.*
White lead ſee *Lead.*
Wiſſet ſee *Blanch.*
Withy Tree ſee *Coal.*
Wooll ſee *Flocks.*
Wood ſee *Gold, Petrefaction.*
Work ſee *Needle.*
Words ſee *Regulus.*
World ſee *Vein.*
Yard ſee *Meaſures.*
Yeſt ſee *Fermentation.*
Zambre ſee *Gold.*
Zaclar ſee *Gold.*

THE *Reader* is deſired to amend or connive at the Omiſſions of the *folio's* of the firſt 80 pages, and to alter theſe words, *p.* 8. *l.* 24. *r.* Tentare. *p.*16. *l.*15. *r.* Ceneres. *p.* 20, *l.* 25. *r.* or woolen. *p.* 29. *l.*15. r. koinos. p.41. *l.* 13. *r.* Warner. *p.* 42. *l.* 11. *r.* Moving. *p.* 60. l. 15. *r.* Lamins. *p.* 64. *l.*31. *r.*Maritime. *p.* 74. *l.* 27. *r.* Thumb. *p.* 92. *l,* 20. *dele* And *r.* It. *p.* 97. *l.* 4. *r.* draining. *p.* 110. *l.* 7. *r.* Herbert. *p.* 120. *l.* 11. *dele* un. *r.* Dreſt. *p.* 121. *l.* 10. *r.* Coaſts. *p.* 128. *l.*11. *r.*Emerald *l.* 21. *r.* Lazuli: Some other there are by want of *points*, or *vowels* or *Conſonants*, or miſplacing of Capital Words, wherein I hope the *Reader* will pardon the *Printer*, conſidering my Circumſtances.

ESSAYS

ESSAYS
EXPLAINING
Metallick WORDS:
Alphabetically diſpoſed, as a DICTIONARY or INDEX to the whole.

Note, *T.* ſignifies the *Teutonical* or *Upper German* Language. *L.* The *Latine.* *A.* The *Anglican* or *Engliſh*: The reſt are written at large, being but ſeldom uſed.

AL A AL

ALCHIMIE. T. *Alkumy*, L. *Alchimia*, but by *Plautus* is writ *Orchimia*, which may well have relation to our word *Ore* or *Oar*. The Lord *Verulam* tells us, 'Tis an ART of Diſtilling or Drawing Quinteſſences out of Metals by Fire, ſeparating the pure from the impure, ſetting at liberty ſuch *Bodies* of Metals as are *bound* and *impriſoned*, and bringing to perfection ſuch as are unripe, and this is the chief ſubject of this Book; now in his Lordſhips mentioning Fire, in this Definition, it ſeems only to relate to *Culinary Fires*: But I apprehend this ART looks higher, even to the uſe of *Celeſtial Fires*; from the *Sun* and *Stars*, and their influential Heats, gain'd by *Contractions*, *Reflections*, &c. which are or may be uſed in this *Art*, as will be ſhewn.

ALCHIMIST, T. *Alchumiſt*. L. *Alchimiſta* (from the Greek *Alkamos*, or Hebrew *Alkum*) is one that is uſed or skill'd in the Art of Alchimy or Chimiſtry, and therefore in

A. he is commonly call'd *Alchimist* or *Chimist*, *Melter*, *Prover*, *Assayer* or *Extracter* of Quinteſſences; and ſuch an one was our Author. But before we fix our Title or *Epithite* to the Maſter of this Science, it is fit to ſhew the progreſſes of it; at the *firſt* ſtep to it, he is called, a *Miner*, or he that finds out and digs (or cauſes to be dig'd) the *Metallick Oar* out of ſuch *Mines*. The *ſecond* is the *Waſher*, or he that waſheth the *Oars* from their uſeleſs Excrements or adherences. The *third* is the *Stamper*, that knows how to beat or ſtamp them by mills or otherwiſe into ſuch Particles as that they may be fitted for ſmelting Ovens (which are the great melting Works, but called *Smelting* for diſtinction from the leſſer.) The *fourth*, is the *Smelter* of the great Quantities in thoſe great Ovens or Furnaces. The *Fifth*, is the *Finer* that ſmelts them over again, and ſeparates the metals in the great Works. The *ſixth* is the *Refiner*, that melts them again ſo often as he thinks fit, till he hath brought the ſeparated Metals to their ſeveral perfections and intireneſs. The *ſeventh*, is the *Prover* or *Aſſayer*, who by *Teſts*, *Crucibles*, *Weights* and other Experiments is able to judge of all Oars, either as they come from their Veins, or made into melted, fined or refined *Metals*; and ſuch an Aſſayer was our Author in all theſe ſeven Gradations, and therefore intituled the far renowned *Lazarus Erckern*, *Berkmeiſter*, or *Chief Prover*, (which we call, *Aſſayer*) of the *Mines* of the Emperor of *Germany*, and the depending Principalities of that Empire.

In what Emperors time he lived, I cannot learn, but his five Books were printed and publiſhed at *Antwerp*, *Anno.* 1629. from which many of the yonger Chimiſts of this Age have derived their skill, by Copies ſurreptitiouſly gain'd from my firſt Tranſlation, about 14 years ſince, which occaſions my printing of it now, being made more perfect.

His Name, *Lazarus*, is in Imitation of the old *Romans*, *Germans* and *Belgicks*, who aſſumed Names ſuting to their temper, or ſome obſervable Actions: the word *Lazarus* ſignifies in Sacred Writ one that was beloved of our *Saviour*,

alſo

alſo one that was raiſed from the *Earth*; and, in the Parable, ſignifies a good poor man in *Abraham's* Boſom, and accordingly in the concluſion of his fifth Book, he ſhews his *Zeal* for *God's Glory*, and his true Belief in *Jeſus Chriſt*, aſſiſting him in his deep Knowledg of *Metallick Science*, and he might well expect, by his Humility of mind to be lodg'd in *Abraham's* *Boſom* (who we find was well verſt in *Metals*:) and the *Roſy Crucius* (of whom *Majerus* and *Spagnetus* do give a full account, being a ſort of *Metaphiſical Chimiſts*, who do make it a chief Principle of that Science, to be ſtrict in their Devotion towards God, and juſt towards men, without which they believe they cannot attain to any Perfection in this *Science*: alſo *Paracelſus* (that great *Chimiſt*) goes ſo far as to make the two Trees of *Life*, and of *Good* and *Evil*, and the *Urim* and *Thummin*, (and many other things written by *Moſes*) to be only myſtically related to this Science; but to paſs by this.

His other Name is *Erckern* (*Erskerus* being but a miſtake in the firſt Tranſlator, for in the Original it is *Erckern*) now *Erk* in *T.* is *Oar*, and *Kern* in *T.* is *granum*, or *grain*; ſo that to *kern* is to *granulate* (which is to reduce *Metals* into certain proportions of the pureſt part which they call *grains*:) alſo *kern* ſignifies to *pulverize* any thing, and ſo may be applyed to *Metals*, whereby it may intend alſo that magiſterial pouder of *Projection* (of which I ſhall ſpeak more:) or elſe it may very well come from the Latin word *Cernere*, which we Engliſh to *diſcern*, the Latine often uſing *c* for *k*; and ſo we do in our Language, ſo *kern* or *cern*, may juſtly ſignify to *ſee*, *know* or *judg*.

Now joyning all together, I may repreſent him as an *humble minded induſtrious man*, that knows how to judge of all *Oars*, and how to manage the Products of them, for the Glory of God, and good of mankind.

By which we may ſee how Goodneſs and Induſtry do improve the Fortunes and Eſteems of ſuch men, and that the exact Knowledge of this Noble Science, and Art of *Proving* or *Aſſaying* Metals, do raiſe them to be owned, and dignified,

even

even by *Emperors*, *Kings*, *Princes* and *States* ; and their very Names renouned to Posterity, as may be seen in Histories.

Now, I have shewn the seven *Gradations* to a *Chimist*, so I must tell you that he looks on himself in an higher degree and justly defined, according to the Lord *Virulam*, for he, not only knows all these seven Gradations , but also knows how to Extract Quintessences or several marvelous Works out of all, and if he would stop there (as *Erckern* doth) it were well for him, but it seems he cannot be content, unless he attains to the high *Elixir* or *Pouder* of *Projection* or *Philosophers-Stone*, which is believed by some of them to have a power of *Transmuting* or turning all other *Metals* into *Gold* ; but by woful Experience of some mens credulity, instead of turning every thing into *Gold*, they have turned all their *Gold* into nothing (*Verulam.*) But our *Author* (though it may well be supposed, that he knew much more than he writ) goes no farther in his Books, than what is safe and fit to be known and publish't ; *i. e.* only concerning Fining and Refining of *Metals*, neither stooping too low to the meaner *Gradations*, nor ascending too high to the *Metaphisical Speculations* , but leaves those subjects to other Writers.

Now, as for the word *Alchimist*, it is the same thing with *Chimist*, but usually taken in an imperfect or ill Sense (like *Ben. Johnson's Alchimist*) that is, one that can or pretends to counterfeit *Metals* : so that to sum up the chief Terms ; an *Assayer* judgeth of the purity of *Metals*, and the *Chimist* improves this purity to *Spirits*, *Quintessences*, *Virtues*, &c. But the *Alchimist*, *Counterfeits and Adulterates* them, by making them appear to be pure, which realy are not pure, but mixt with other *sophistications*, (*Verulam.*) Of this latter our *Author* is not Guilty ; so as he stands for a *renown'd Assay-Master*, a good *Chimist*, and one that understood, but was not a *Sophisticating Alchimist*, nor a *Lapidarian Philosopher*, or *Metaphisical Projector*. See Assaying.

Alkali or *Alcali*, reckoned by Doctor *Wilkins* amongst Stones

Stones, but here and in other parts of the V. Books, call'd *Sal Alkali*, which is a *Salt* made of the Herb *Kali* or *Salicornia*; vulgarly call'd *Glasswort*: The herb is hot and dry, and therefore such Salts of that Quality are called *alcalous*, and this *Salt* is often used by our Author, as having a nature to discoagulate Metals, by opening their Bodies. (*l.* 1. *c.* 32. *s.* 4.)

ALIMBECK, *See* Limbeck.

ALLAY, T. *Linderen.* L. *Mitigare.* A. *to lessen* or *allay*. See *Money* and *Coin.*

ALLUM, T. *Alaum.* L. *Alumen*, from *Lumen*, in respect of its transparency and nearness to *Christal*, and is accounted among the brighter stones; of this Mineral there are several sorts from several Mines, and *Allum* works erected in *England*, and they are also in many parts of *Europe*, some more acid and sharp in taste than others, by which their goodness is chiefly distinguished: and this Mineral is of great use to *Chimists*, *Dyers* and other *Artists*. *l.* 2. *c.* 4. *s.* 5.

AMEL, or to *Enamel*, T. *Eyn-brennen*, and is call'd the *metallick Calx* or Lime, compounded of two parts, *viz.* one of Lead and one of Tin, and being well calcin'd in an *Oven* of *Reverberation* makes the *Amel*, and in the making 'tis so delicatly ting'd with variety of colours, (the Art being grown to so much perfection in this age) that all sorts of Features, Images, Landskips, &c. are so lively represented to the eye in a condensed work of the same, that they are as delightful and more durable than those which are done with oyl or gums, *l.* 2. *c.* 4. *s.* 1. see *Nealing.*

AMONIACK, see *Armoniak.*

ANTIMONY, T. *Speiz* and *Speiz-glass* (which is properly Glass made of *Antimony*) L. *Stibium*, and it is also called by some Mineralists *Red Lion*, *Wolf* and *Proteus* (in respect of its various qualities). It is a heavy, bright Oar, like *Lead*, but more speizy and porous, and less ponderous, and some give it the name of *white stone* or *imperfect Metal* (because they say, it is the beginner or producer of *Silver* or *Lead*)

and the extracts made out of it, are of singular Virtues of, which his late Highneſs *Prince Ruperts* red drops were chimically made, and given with good ſucceſs for moſt Diſeaſes, *l.* 4. *c.* 17.

AQUA FORTIS, (which for brevity is printed *Fort.*) T. *Scheid-waſſer*, called by Lat. Chimiſts *Aqua ſeparatoria*, and is a compoſition of *Nitre* and *Vitriol*,&c. and this liquor is uſed for diſſolving and ſeparating *Gold* and *Silver*, and hath many other excellent properties, as may be collected from the 5 Books. *l.* 2. *c.* 16. to *c.*34.

AQUA *regis*, is a water made of *Aqua fort.* and other compoſitions, and is of a more ſtrong and corroſive nature than *aqua fort.* and it is obſervable the *aqua fort.* is a ſpecifick for *ſilver*, and this *aqua regis* for *gold*, for it will touch only *gold* and not *ſilver*. *l.* 2. *c.* 28.

Aqua argentea, ſee *Quick ſilver*, and *metals*.

Aqua Vitrioli, ſee *Vitriol*, and *minerals*.

Aqua dulcis, ſee *common water*.

Aqua fontis, ſee *Spring water*.

ARGOL, T. *Weinſtein*, L. *Tartarum*, and in Engliſh *Tartar* or the *Lees* of *Wine*, which ſticks to the ſides of wine-Veſſels, hard and dry like a cruſt, and therefore ſometimes called *Argol-ſtone* from its compacted hardneſs, and this is of great uſe in *metallick Operations*, *l.* 1. *c.*10. *ſ.*17. and other places. *l.* 1. See Feces.

ARITHMATICK, T. *Rechenkunſt*, L. *Arithmatica*, the *Art of Numbring*, or *Reckoning*, according to the T. and this Art of all others is the moſt aſſiſting to the Metallick Science, in judging of the goodneſs of Metals, after Fining and Refining them. *l.* 1. *c.* 1.

ARMENICK. See Armoniack.

ARMONIACK, T. gives it the Latine Name, *Bolus Armeni*, and we *Bole Armoniack*, and I find theſe words of kin, both in their Orthography and Pronuntiation, *viz.* *Amoniack Armenick* and *Armoniack*. The firſt *Pliny* tell us,

l. 24.

l. 24. is a Gum which he calls *Gumma Amoniaci*, of a glutinous nature (like other Gums) and ſo may be uſed for Metallick Veſſels. The ſecond *viz.* *Armenick*; I find the word *Sal* always joyned with it, and ſo called *Sal Armenicus*, and this Salt was antiently accounted a natural Salt, but that being now unknown to us, we uſe the *Armenicus*, which is made of the *Urine* of *Elephants* or *Camels* (as 'tis ſaid) boyled to a *Lixivium* or Salt, and called *Sal Armenius* or *Armeniacus*, and this is of great uſe for purifying and refining of Metals. To the third *Armoniacus* the word *Bole* is added, I ſuppoſe for diſtinction ſake: *Pliny*, c. 35. mentions a Stone, which he calls *Lapis Armeni*, of which he counts ſeveral ſorts, but the beſt of thoſe he ſaith, are of a *blew colour*, and calls it *verd de Azure* (being of great price and eſteem with *Painters*, but the common *Armoniack* he calls *Synoper* (and we *Synople*) from a City of that name, where it was plentiful, and 'tis probable this is the ſame which we call *Bole Armoniack*, being of a reddiſh colour, and this is oft uſed by our Author, and for diſtinction the word *Gum* is put to the firſt, *Salt* to the other, and *Bolus* to this: which I write to prevent Errors in Medicines or Metallick Experiments. *l.* 2. *c.* 20.

ARSNICK, T. *Arſenick*, L. *Auripigmentum*, We, *Orpine* or *Orpiment*, and commonly *Rats-Bain* (being uſed to kill *Rats*) of *Arſnick* there are two ſorts, yellow and red, (which ſome, by miſtake, eſteem to be red *Oker*) *Pliny*, *l.* 34. ſaith, it is of the ſame ſubſtance with *Sandarack*, and inclines to that Colour, the beſt of which, ſaith he, reſembleth *Gold*, and therefore I ſuppoſe called yellow *Orpiment*.

There is alſo a *white* or *Chriſtalline Arſnick*, which is compounded of *Salt* and the yellow *Orpiment*, ſo becomes tranſparent like *Chriſtal*, and from thence is made the *white Rats-bane*, and it may be obſerv'd this *white*, conſiſts of two parts, *viz.* a cruſty or external part, and a *Chriſtaline* or *internal* part, and this makes metal *brickle*, the other *ſolid*, and of the

the *Regulus* of this mineral a good metal may be made, *l.* 1. *c.* 14. *f.* 1. See *Sulphur.*

ASHES, T. *Aschen*, L. *Ciner*, A. *Ashes*, and these are made so by the power of *Fire*, from metals, minerals, stones, bones, earth and wood; which puts me in mind of those trees which plentifully grows in *England*, call'd *Ashes*, T. *Esschen* or *Asschen-Baum, quod optimos cerneres efficiant* (*Minshaw*) but the *L.* calls it *Fraxinus*, and of this *Ashen-wood* I have seen the great effects of it at *Yarmouth* and *Laistoff* in *Suffolk*, for with this wood and no other they dry their *Herrings*, (which is a profitable commodity to them) and it seems that the *Salt* and drying Vapours of that Wood, do cure (for so is their term) their *Herrings* of all *malignities*: and doubtless that wood is most proper where it is to be used for dissolving metals, and the *ashes* of it rather than any other for *metallick* uses (except *Bone-ashes*) and especially for *Salt-Petre* which is the Subject of the 5th Book. *l.* 2. *c.* 20. *f.* 5. See *Dust, Bone-Ashes, Pulveration*, &c.

ASSAYER, T. *Probirer*, L. *Probator.* A. *Assayer* or *Tryer.*

To ASSAY, T. *Probiren.* L. *Probare.* Which we call also to *Assay*, *Prove* or *Try Metals*, all intending the same thing, though different in Dialect; but there is another Word of the like signification, which is written with an *E*, as *Essayer* and to *Essay*, &c. both are rendred, by Dictionarys to *Try*, L. *Tentare*, *Probare*.

Now I think, some have committed an Error herein, and ought to have made a more clear distinction, for I take *Assaying* to have relation only to things of Weight, as Metals, *&c.* from the word *As* or *Assis*, (which signifies a pound Weight, or 12 Ounces, or the whole of any substance which may be divided into parts) and especially applicable to the greatest or smallest Coins that are made of any Metal, which many times were, and still are of Copper or Brass, which the L. call *Æs*, and thereupon I suppose it is sometimes writ *Essaying* (without a diphthong) and so confounded these two words in their applications, and to confirm my just distinction of them

We read in the *Stat.* of *H. 6. c.* 12. that the Kings Officer of the Mint, who, (as the Statute ſaith) is indifferently appointed between the Maſter of the Mint and the Merchant (which brings Silver thither to be minted) is called the *King's Aſſayer*, and not *Eſſayer*, and in the Records *Aſſaiſiator* not *Eſſaiſiator*, (*See* Goldman's *Dict.*) And ſome latin Records renders it *metallorum probandorum Præfectus*, and the *Italians*, *Aſſaggiatore*, and the *Belgick* calls *Aſſay*, *Examen Probitatis monetæ*, applying the word wholy to *Metals*, but *Eſſay* they define it *ſpecimen artis*, or *Exemplum quæſitæ artis.* (*See* Binworts *Biglotton.*) 'tis true the *French* make the two words indifferent: yet further to ſupport this diſtinction in our *Engliſh Language*, the ever to be admired Lord *Verulam* calls his excellent Obſervations on Men and things, *Eſſayes* and not *Aſſayes*, and ſo Dr. *Don* (a Critick in our Language, and in general Learning) calls his quaint Diſcourſes on ſome Pieces of Divinity *Eſſayes* and not *Aſſayes*, and therefore to prevent the miſapplication of thoſe two Words (with ſubmiſſion to thoſe of this preſent age, who write themſelves *Eſſayers* and not *Aſſayers* of *Metals*) I take leave in theſe *Diſcourſes* to apply the word *Aſſayer* and *Aſſaying* to *Metals*, and metallick ſubſtances, and the word *Eſſayer* and *Eſſaying* to *Accidences*, and other ingenuous Undertakings, and not to *metallick* ſubſtances, having ſuch Authorities, as I have cited to countenance me, *l.* 2. *c.* 2.

ATHANOR, T. *Heinzen thurne*, L. *Fornax*, which we alſo call *Kiln* or *Oven*, and indeed is only a *Furnace* of ſeveral ſhapes, ſo this is called *Athanor* from its diſtinct ſhape from others *Furnaces* or *Ovens* being like a *Thurn*, which in *Teut.* is a *Tower*; but from whence the word *Athanor* to which the name of this kind of *Furnace* is given, I cannot find, unleſs it be from the *Greek* word *Athanatos* which ſignifies *immortal*) and ſo the ſpirits of the Metals which are drawn from thence into leſſer *Ovens*, and ſo into *Recipients*, do thereby perfect *Quick-ſilver* which may be ſaid to be of an immortal nature.

Or elſe from the *Saxon* word *Thane*, which ſignifies *No-*

ble, as alſo a *Servant:* and thence called *Athaner* or *Athanor*, becauſe it hath thoſe two properties, as being the moſt noble of all *Furnaces* for *Metals:* and alſo the moſt *ſerviceable* in the *operations* of *refining Metals*, *l*. 2. *c*. 7. *ſ*. 2. See *ovens*.

BA BA

BACON (ſignifying here the Fat of *Hogs* or *Swine*) the Original of which word I cannot trace, with any ſatisfaction to my ſelf, either from the *T*. *Speck* or L. *Lardum*, nor from a *Boar*, T. *Eber*, which is pretty near L. *Aper*) nor from *Sow*, T. *Saw*, L: *Sus* and *Scrofa*, nor from *Swine*, T. *Schwene*, L. *Porcus*, but refer you to *Skinner's* Dictionary. And though this is oft mentioned by *Erckern* for greazing of Inſtruments, yet in reſpect of the Salt in it, I conceive it were better to uſe the fat of a *Boar* (eſpecially when any Metal is concern'd) becauſe I know it is as effectual in curing of wounds at diſtance, as the ſo admired *unguentum Armarium*, commonly called the *Weapon-ſalve*; and ſince it hath ſuch a kindneſs to *Metals*, I know not how it may not be better uſed than *Venetian* or *Smerna Soap*, for improving Gold, Silver, Tin, &c. and ſo in ſtead of *Gold-ſoap* call'd *Golden Bacon*. *l*. 2. *c*. 4. *l*. 4. *c*. 15. *l*. 5. *c*. 10.

BALLANCE, or a pair of *Scales*, T. *en wagmit Zwyen Schuſtun:* but the *L*. call it *Bilanx*, *habens duas lances*, or two little Veſſels to contain the things to be tryed, and alſo *Statera*, becauſe it demonſtrates the ſtate of the thing in queſtion, and the *tongue* of this Ballance is in the *T*. *Wigzunglain*, L. *Lingua*, and *Examen*, becauſe by ſtanding in an *equipoiſure* or not, it doth as it were ſpeak or tell you the difference or certainty of the

Weights,

Weights, in queſtion, and the Latine hath another word for it, *viz. Trutina*, from the Greek *Trutane*, which not only ſignifies a *Ballance*, but a dilligent examining, or good advice and judgment, and from this *Trutina* we borrow the word *Truth*, and as the natural *tongue* of men ſpeaks the truth of the Heart, ſo this artificial *tongue* ſpeaks the *truth* of the *Ballance* and *Weights*, and this Ballance is very neceſſary to the performance of this *metallick ſcience*. *l.* 1. *c.* 35, 36, 37.

BEAM, the word is applyed to the *beam* of an Houſe, and the *beam* in the *eye*, the *beam* of a plough, a *Weaver's beam*, but though we uſe the ſame word for many things in Engliſh, yet they all differ in other Languages by diſtinct words: but this is called T. *ſchnalwag*, and in Latin the ſame with *Ballance*. See *Ballance*.

BELL, T. *Schelle*, i.e. *ſonitus*, that which yields a ſound, and it either comes from *Belle* an adverb ſignifying that which is pleaſing to the ear, or from tunable Inſtruments that were uſed *in Tempore Belli*, and though by the *Italians* they are called *Campane*, upon pretence of their original, from *Campania* a noble region in *Italy*, yet we find in *Exod.* 28. that there were *golden Bells* upon *Aarons* Veſt, which all the Verſions into Latin call *Tintinnabulum auri* (of which the Interpreters give little account) and certainly they had little or no ſound; but the metal of our bells have no gold in them, but what is caſually mixt with other metals, for they are compounded of *Copper*, *Tin* and *Braſs*, and a little *Silver:* ſometimes the Artiſts or maker of theſe are called *Bell-founders* T. *Glockengieſſer* from *Gloken* which we call *Clock*, by changing *G* to *C*) and the *art* of mixing, making aud caſting them (in reſpect of their diverſity of ſounds) is of as tranſcending a nature as any one *art* or *ſcience*, for the proportions of Ingredients are according to the great skill and Judgment of the Founders adequated to their various uſes.

Antiently, and ſtill, ſolemn *Prayers* are uſed at the caſting them, and formerly they were with great Ceremony *baptized*, pre-

presuming that many spirits did attend them: and I remember an old *sexton* did affirm, That by the sound of a *Passing-Bell*, for one dying and dead,he could tell how many hours or days after, some other of his Parish should dy: But whether this *prognosticating* quality be in them, I shall not dispute, but we are certain, that the *Harmony* of a Consort of them, are very pleasing to musical ears; and 'tis observable, that this *Art* is only from *Metals*. *l.* 1. *c.* 18. And not only this of *Bells*, but most of the choice *Instruments* of *Musick* were and still are either in the whole or in parts composed of *Metals*; Such as are wholly of *Metals*, are *Trumpets*, *Sag-bots*, *Cimballs* (*soft* and *triumphal*) *Organ Pipes*, &c. such as are in part, *viz*. the strings of the *Harp* (which we now call the *Irish Harp* (being strung with wire) in distinction of the *Welsh Harp* strung with *Guts-strings*) also the strings of the *Harpsicon*,and *Poliphant* (which I have often heard with great pleasure, but now out of use) also the *Tabaret*, and the *Cittern*, though now of small esteem, yet was devised by *Amphion*, *Pliny* l. 7. p. 187. and many others,amongst which I must not forget the *Monochord* or *Tuba marina*, whose Entrals are curiously composed of *Metals*, although the string, which stirs up the reverberating Spirits of the *Metal*, is composed of *Guts*. Now as *Petrus Bongus* hath writ a Book de *sacris numeris*, and *Jonston* de *sacris Arboribus* (with Sculptures) I wish some would write *De sacris Instrumentis Musicæ*, with their *Sculptures*, especially of those wherein *metals* are imployed, for doubtless the subject would afford excellent variety.

But besides this musical part of *Metals*,the word *Bell* is also applyed to a *Glass* with a round bottom and long neck, which the *Chimists* call a *matrass glass*, or *long Bell*, Sculpture I.

BELLOWS, T. *Blaszbalgh*,and to blow *Geblasz*. L. *Follis* & *follescere*: of these there are three sorts mentioned in *Erckern*, 1. the *Philosophical Bellows*, 2 The *great Bellows* (which requires eight Ox-hides)and 3.the *common Bellows*, which *Smiths* also use, and others for common fires, as you often find in the

Sculptures

Sculptures, and all theſe in imitation of the nature of a *Cow* Beaſt, which in drawing in and forcing out her breath, is ſaid to *Bellow.*

BLANCH, T. *Blanck, Weiſs* and *Bluk,* all ſignifying *white,* or a white *Silver* or *Tin,* when it is melted, for the meer *Oar* of Tin is of a *ruddy colour,* and *white* when *melted*; and this by the Tranſlator of *Weckerus,* is called *Blenck*; which word I like, (though I find it not in any Dictionary) for I had a Mannor in *Suffolk,* called by the name of *Blenches,* and it appeared ſo in my Antient *Court Rolls,* for that the Soyl of the Mannor, conſiſted of a white Clay and Chalky temper, and the next Village is *Wiſſet,* which conſiſted alſo of the like Soil: *Blench* and *Wieſs* both ſignifying *white,* ſo that *Blench* and *Blanch* have the ſame ſignification of *white,* and ſo the word is uſed for the *whitening, blenching* or *blanching* of *Silver*; the word is alſo uſed to *Almonds,* *viz.* when the ſuperficies or dull part is taken from them by boyling Water, they are then called blencht or blancht *Almonds.* See Bone Aſhes.

BISMUTH, is a *Crude Oar* or kind of Silver *Marchaſite,* and of a white, hard and brittle Body, and I conceive is the ſame which *Erckern* calls alſo *Wiſmut,* or *Wiſmuth Oar* and *Spelter,* *l.* 4. *c.* 10. and ſometimes called *Tin Glaſs.* See their Alphabets.

BITUMEN, is accounted both among *Gums* and *Pixes,* and alſo among *Sulphurs,* but that which *Erckern* ſpeaks of, intends Brimſtone, which the T. calls *Schwebel,* L. *Sulphur,* and this is either *Natural,* from the *Lake* called *Aſphaltis,* (where once *Sodom* and *Gomorrah* ſtood, alſo from the vomiting of the *Hill Ætna* and *Viſuvius*) or Artificial made by *Fire.* See Minerals.

BLACK, See Colours.

BLEND, or *Blent,* T. *Ablinderne,* L. *Miſcere,* A. to *Mingle,* that is, when *Metals* are *blended* or *mingled* in *lumps.* *l.* 4. *c.* 2. &c. And this word is much uſed in the *North* parts of *England,* for *mixt* or *mingled* matter, which ſome call *Hots-Potch.*

BLEW, See Colours.

BLINK, T. *Blinkin* or *Blicken*, L. *Micare* and *Nictare*, A. *to Shine*, it is commonly uſed to thoſe that are *blear Ey'd*, or often *twinkle* with their Eyes: it is alſo applyed to dead and *ſharp Beer*, and to the *brouſs* or *loppage* of Trees, given to Deer (ſee *Skinner*) but in our Author only applyed to *bright Oars*, or melted *Metals*, *l.* 1. *c*, 23. &c. & *l.* 2. *c.*24. *viz. blink Gold* and *blink Silver*, that is *bright* or *clear Gold* or *Silver*.

BLOUD, T. *Blut*, L. *Sanguis*, apply'd to the *Bloud* of *Oxen*, &c. and is often mentioned as a good mixture, for Inſtruments and Cements for *Metalick uſes*. See l. 2. c. 20. and Ox.

BOYLING, T. *Seiden* and *Kochen*. L. *Coquens*, *l.*5. *c.*7. *ſ.*1. we have many words for this, tending to the ſame ſence, and yet with ſome Gradations, as when any liquid matter begins to ſtir with the heat of the Fire, we call it *ſimporing*, it may be from *ſimpo*, a Pot wherein the old *Roman* and *Gretian* Prieſts were wont to drink their cheering Liquor, and therfore the word *ſimporing* is uſed for *ſmiling*, and when it ſtirs more, 'tis called *ſeething* (which differs little from the T. *Seiden*) when it ſtirs to bubble, it is called *Boyling*, from *bulla* and *bullire*; but antiently *Boyling* was called *Plawing*, from L. *Plaudere*, to *rejoyce*, becauſe the *fire* had the full effect of the heated liquor, and therefore the *Pſalmiſt* ſaith, *Plaudent Flumina vola*, let the *Floods* clap their *Hands*: *i. e.* let them *plaw* or *rejoyce* in their *plawing* or *boyling waves*, but I do not find my ſenſe of the word *plawing* confirmed in any Dictionary, as I can now peruſe; but this I ſhall affirm for the Sence and Antiquity of the Word, That there is a *Marſh* in *South-Walſham* in *Norfolk*, belonging to the now Duke of that County, which with other *Marſhes* were gain'd from the Sea, in the time of the old *Romans* (as 'tis generally ſaid) to which my Grandfather and my ſelf were Tenants for near an 100 years, and in theſe *Marſhes* there was one parcel called by the name of *Plawing-Well Marſh*, within 3 miles of *Yarmouth*, and about a mile from the

the Sea, and the Marſh is ſo called, and ſtiled in Writings, from a *Well* or place in it of about two yards broad, and about 18 Inches deep, only in the middle of it is a little *hole*, the bottom of which I could not then fathom by any Pole or Inſtrument that I could get, and from that *hole* the water conſtantly *bubbles*, *boils up* and *playes*, which was the word uſed in the *Leaſe*, and in other Records ſufficient to juſtify the Antiquity of the word.

Now having ſpoken what I can of the word, give me leave to ſpeak of the water, which keeps at one *ſcantling*, neither ſwelling higher nor decreaſing ; but if it decreaſe at any time, it foretels a dearth) ſo that the motions of it cannot be attributed to the neighboring Motions of the Sea (which are *regular*, *lunary* or *ventilary*) nor any other cauſe that I could find ; unleſs it be from a conſtant motion of Cattle (grazing in theſe and the neighboring marſhes, which being only thin & graſſy coverings of the waters, thoſe beaſts by *quaſſation* and conſtant compreſſure of ſuch *flexible* grounds, may eaſily cauſe this *Ebolition* or *plawing*) I confeſs, I am the more content with this reaſon, becauſe we daily ſee, that a little *Compreſſure* in a large veſſel of *liquids* will make it riſe and run over, and we often find in ſolid *Bodies*, Compreſſure will have great effects at diſtance, as in the year 1648. when the Committee-houſe at *Norwich* was blown up, by the firing of 40 barrels of *Powder*, it cauſed by *compreſſure* ſuch a motion in the *Earth*, that at *Thorp Market* (15 miles from *Norwich* (near *Cromer*) Mr. *Allen* who dwelt there in good repute) told me, that as he was ſitting in his Parlor there, he was very ſenſible of the *quaking* of the Earth; which upon Information of what had paſt the day before at *Norwich*, and comparing the punctual time, he found the ſhaking was cauſed by that *Gun-pouder*, and I, being then in the *Country*, ſoon after went into the *City*, where I obſerv'd, that all the *lower windows* of the *City-houſes* were ſhattered by the *Air* and *Earth*, but the *upper windows* (that had only the more tender motion of the *Air* to offend them)

them) had little hurt, and this was general, except in Churches whose *Windows* were all shatter'd, having no floors to defend them against the motion of *Earth* and *Air*.

I was pleased with these outward accidental causes, but soon after I saw a Spring on one side of the highest Hills in *Darbyshire* within the *Peak-Forest*, and 30 miles from the Sea) that eb'd and flowed four times in the space of an hour, call'd *Tides Well*, and for this I will not pretend to give a *Reason*, being so far from the Sea, or any probable outward cause.

BOLUS, see *Armoniack*. It signifies a certain proportion; from whence we might have the word *Boul* or *Bole*, which is used by *Miners* to measure out their dig'd *Oars*, both for the *King*, *Proprietor* or *themselves*, or for other uses.

BONE (*Ashes*) T. *Bein* (*Ashen*) Lat. *Os* & *Ciner*. A. *Ashes*, and from *ciners*, *cinders*: so as the Latines have no proper word for it, but *Ciner* the *Cinders*, or *ashes* of *Ossium*, or bones in the plural. Now the Latines have the like word *Os* signifying a *mouth*, distinguished in their Genitive cases, one making *Os*, *ossis*, the other *Os oris*, one signifying *spiration*, from the *Greek*, the other *duration*, and they may well be coupled, for the *nourishment* which goes into the *mouth* gives *nutriture* to the *Bones*, and is the Original of its *duration* (of which I have writ more fully in my *Fodinæ Regales*) and our Author gives several Directions what *Bones* are fittest to be used (to the making of *Tests* and *Crucibles* for dissolving *Mettals*) either of *Beasts* or *Fishes*, of which you may see his Opinion in several places, *l*. 1. *c*. 5, 6, 7, *&c*. See *Ashes*, *Incineration*, *Pulverisation*.

Now *Pliny N. H. l*. 11. *c*. 37. tells us that the *bones* of *Asses* have a more musical nature in them (being made into *Pipes*) than any other *bones*, so that it may be worth the Trial for *Bell-Founders*, who make their *Furnaces* and *Tests* of *Bone-Ashes*) to try if *tests* made of *bones* of those dull *Asses*, in stead of other *bones*, can make their *Bells* of a more active sound.

The

The ordinary *Bone-Ashes* made of *Beasts* is a confiderable *Trade* about *London*, not only for *Goldsmiths*, &c. but for our *Mines* in *England*, for whilft the *Leasees* of our *Society* did work the *Mines* of *Consumlock* and *Talibont* in *Cardigan shire* in *Wales*: (two old *Roman* Mines, as I have fhewn elfe where) every year there were at leaft 800 Tun fent from hence thither by *Sea*; by which may be gueffed what is, or might be, fpent in the other 28 Mine Counties in *England* and *Wales*, if our *Mines* were duly fet on work, but they being neglected, we fend great quantities to other Nations, for the fame ufe; for which the Merchants pay outward 6 *s*, 8 *d*, for every thoufand Bones, and we pay for their bringing them into us 1 *l.* 5 *s.* for every Barrel of their Afhes, which we might burn and employ for ours.

BORAX, T. *Borras.* L. *Borax*, and *Christocolla*, which *Pliny* calls the *Ordure* or *Dung* of *Gold*, yet *Gold-fmiths* and *Silver-Smiths* ufe it for their chiefeft *sodering* of *Gold* or *Silver*, and joyning one *metal* with the other, and indeed bringing all metals to perfection, befides it hath medicinal properties, *l.* 2. *c.* 4. *f.* 2. and in many other places.

Pliny reckons it among *Minerals*, and defcribes it to be a *green Earth*, but of four forts, the *best* from *Copper Mines*, the *second* from *Silver*, the *third* from *Gold*, and the *fourth* and worft from *Lead*, he tells us alfo of an *Artificial Borax* which he faith comes from a *putrified Vein* of *metals*: there is alfo *another kind* made by *Art* of *Roch Alum* and *Bole Armoniack*, and other Ingredients, which is ufed alfo by *Goldsmiths*: But the right *Borax* hath another quality, for it being mixt with *Arsnick*, it takes off the poifonous quality of the *Arsnick*, whereby it may be fafely put to *metals* as a *dissolvent*.

BOTTELLS, T. *Krugs*. See Inftruments and their *Cruises*, *Jugs*, *Pots*, &c.

BOTTOM, T. *Boden*, *l.* 1. *c.* 33. L. *Fundus*. A. *Foundation*, or the lowermoft part of any thing: the word is alfo ufed for a *bottom* of *thread*, T. *Vin-Gleuen* or a *clew* of

thred. L. *Glomus*, which is only the Foundation on which the *thred* is wound, and so call'd the *bottom.*

BRAN, T. *Kleyen* & *Gruesck.* L. *Aplauda* & *Furfur*; because it makes a double theft, by taking away it self, and also much of the good *flower* with it: however this *Bran* is very useful, by its mixtion with such stuff as is used for *glasing* and strengthning the outward and inward parts of such earthen *Pots* or *Vessels* as are made for *Metals*, by making the matter stick the more close and firm, and is it self destroyed like many innocent men, to make way for others. *l.* 2. *c.* 20. *s.* 6.

BRASS, T. *Ertz.* L. *Æs*: and it is a great Error that most Writers run into, by promiscuously giving the title *Æs* for both *Brass* and *Copper*, as if they were the same *Metals*; whereas *Æs* or *Brass* is not a proper *Metal*, but compounded of a *Metal*, viz. *Cuprum* or *Copper*, and *Lapis Calaminaris*, or *Cadmiæ*, which is a *mineral*, and from the mixture of these two, *Brass* is made, as may be seen in *Erckern*, *lib.* 3. *c.* 28. which in T. is called *Galmay*. Now there is of this *Calamin* two sorts, *Natural*, as in the third *Book*; and *Artificial*, *l.* 4. *c.* 8. *s.* 7. made of the *dregs* of *Metals*, but the *natural*, he saith, comes from *Britain*, and indeed we have mountains of it, especially in *Glocester-shire*, *Sommerset-shire*, and *Notinghamshire*: but we let the *Calaminaris* go for *Ballast* into *forein* parts, in very great quantities, before it be wrought, so as the best *Brass* beyond Seas is made of our *stone* rather than their own, which deserves a further consideration: and I remember about 30 years since, one *Demetrius* a *German*, did set up a *Brass*-work in *Surry*, and with the Expence of 6000 pound (as he told me) made it compleat and to good profit: but the forein Merchants joyning with some of ours, found wayes to bring him into *suits*; and meeting with no incouragement, he was at last necessitated to submit the work, to his own ruin, and unspeakable prejudice to the Kingdom, in loosing so beneficial an Art, having here both the best *Copper* and *Calamine* of any part of *Europe*. See *Stones* and *Copper*.

Now

Now whereas *Pliny*, *Cap.* 33. ſpeaks of about 18 ſeveral *Mines* of *Braſs*, we muſt not underſtand it as a ſpecifick *Metal*: though the word *Æs* is vulgarly applyed to both, but thoſe *Mines* were either *Copper mines*, capable of being made *Braſs*; or ſo many ſeveral ſorts of *Lapis Cadmiæ* or *Calamin*, from the compoſition of all which with *Copper*, *Braſs* was made more or leſs both in *Quantity* and *Quality*: and this Art of compoſing it, is ſaid, by him, to be firſt invented by *Cadmus* a *Grecian*, contemporary with *Joſhua*, in whoſe time the word *Braſs* is firſt mentioned in the *Sacred Story*, Exod. 25. 3. And it is obſervable, That though in the compoſition of *Braſs*, there is more of the *ſtone* than of *Copper*, and that *Copper* is a *Metal*, and that other a *Stone*, yet it takes a new name of *Braſs*, and not its own, or of the *Metal*, *Copper*: and being thus made *Braſs*, it is an *Imitator* of *Gold*, both in *Colour* and in many *Virtues*, and in ſuch eſteem, that the *Roman* Treaſurers were call'd *Tribuni Ærarij*, rather than *Aurarii*: and *Camerarius* ſays, that the *Ægyptians* (long before the *Romans*) had ſo great Veneration of *Braſs* that they made *Images* of it, and laid them in the graves of their *Kings*, to preſerve their *Bodies* from Putrefaction, and to men of leſſer quality they nailed their dead bodies with many *braſs* nails.

Alſo *Virgil*, *Horace* and *Homer* are all full of their *Encomiums* on *Braſs*, and therefore it may well have the honour of a ſeventh Metal, though compounded of a Mineral. Now as the common Braſs is of a *Goldiſh* colour, ſo *Pliny*, l. 34. c. 11. tells us, of a white braſs, (which is no other (as I conceive) than *Braſs Tind-over*, and called *Laten*, or *Auricalcum*. See Latten.

BRICK, A. *Brick*. *T*. *Gabachen-ſtein* or (a ſtone made by *Art*) L. *Later*, a *ſide*, becauſe 'tis uſed both to *outſide* and *inſide* of *Buildings*; as antient as the *Ægytians* who forc'd the *Iſraelites* to make it: the Makers of it is called, *T*. *Bachen-ſtreinlin*. L. *Laterculus*. P. 5. c. 7. ſ. 1.

BRICKLE, T. *Zee bruch-lech*, L. *Fragilis*, and this we vulgarly call *brittle*, but doubtleſs it come from *Brick*, the

nature

nature of which is *fragile* or more eaſy to be broken in pieces, and ſo made into *Pouder*, which both whole and in *Pouder* (as thoſe from *Tile*) are uſed by *Aſſayers*. *l.* 1. *c.* 32. *ſ.* 3. *l.* 2. *c.* 44. *ſ.* 2. *&c.*

BRIMSTONE, ſee *Bitumen*, *Sulphur*. *l.* 1. *c.* 16. *ſ.* 1. thence *Bitumenous*, *Sulphureous*.

BRITTAIN, See *Mines* and *Mineral Countrys*. l. 3. c. 28. ſ. 5.

BROOM, T. *Baſſem*, L. *Scopa*, A. *Beſom* and *Broom*; but I conceive this word is from the Plant, which we call *Broom*, (T. *Ginſter*, L. *Geniſta*) of a flexible nature, and ſo uſed to ſweep *Rooms*.

BROWN, T. *Braun*, L. *Fuſcus*. See *Colours*.

BRUSH, T. *Buerſt* (and yet to bruſh, they ſay *Kethern*) L. *Scopula* and *verricula*, *veſtes purgare ſcopulis*, *Sculpture* 7.

BUBLING, *Ein Waſſer blaſon*, from T. *Blaſs* a *Bladder*, being but a more durable *bubble*, L. *bulla*. *l.* 2. *c.* 35. *ſ.* 7.

BUCK, *Bucking*, and up-*Bucking*, and to *Buck*, uſed often in the 2, 3, 4 & 5 Books, in the T. is *Lawgen*, L. *Lixivare* from *Lixivium* or *Lee*, (ſee *Lee* of *Aſhes*) but the *Italians* call it *Bucato* or *Waſhing*, from whence our word *Buck*, or properly *Buc* (to diſtinguiſh it from the Male of a *Doe*) is called alſo *Buck*, which may have its name too from *Bucceto*, from his frequent mingency, piſſing or making Water oftner than Females, and this word Bucking is applyed often to thoſe that are *Waſhers* of the filth out of *Linen* or *Cloaths*, which the common people uſe to do with a piece of *broad* and *thick Wood*, which they call a *Clapper* or *Bat-ſtaff*; but for more Expedition, the *Fullers* have invented *Mills*, with ſeveral *Stamps* for their Cloths, which by the force of water do raiſe and let fall their *Stamps*, by which the Fullers-Earth with the Water do make our Cloaths fit for uſe; but whether the Metalliſts did teach them that *Art*, I ſhall not enquire, only the Metaliſts which we converſe with here, have two ways of Bucking or Waſhing their Oars, from the dirt or Earth about them; one by a Mill, which they call a Smelting-mill, by which with the force

of

of Water, certain Stamps or Hammers do beat and waſh the Oars, and thoſe Workers are called *Smelters* at the Mill, and after that, there are other leſſer *Buckings* in *Mortars* and *Tubs*, to prepare the Metal (more free from Rubbiſh) for the Melters; See Smelting Melting, and Menſtruum.

BURNING of *Metals*, *i. e.* reducing them to *Aſhes* or *Pouder* for uſe. *l.* 2. *c.* 2. See Aſhes, Calcination, Roaſting, *&c.*

CA CA

CADMIA, See *Calaminaris.*

CAKES, T. *Schiben*, or pieces of Metal, melted into the form of Cakes. *l.* 3. *c.* 26. By this word *Cake*, we muſt not underſtand ſuch *Cakes* as in Latine are called *Placenta*, from *placere*, to pleaſe the Pallat, by their ſeveral pleaſant Ingredients; but here it relates only to the form of it, ſometimes *round* and *Convex*, but moſtly *Flat*, like pieces of *Plate*, and therefore the *Refiners* (for diſtinction) do call *Lead*, caſt into a ſolid body, *Sows* and *Pigs*; *Tin*, *Blocks*; and *Iron*, *Barrs*; but *Silver*, *Gold* and *Copper* ſo caſt, they call *Cakes*; and *Copper* ſometimes *Roſe-Cakes*, or *Cupri Roſa*; and though they be not *Edibles* (or bear the name of *Placenta*) yet without *Mony*, which is derived from thoſe metal'd *Cakes*, we could not have ſuch things as are *placentious* or pleaſing to us.

To CALCINE, *Calcinate*, *Calcinize* and *Calcination*, T. *Calcineren*, L. *Calcinare*, both Languages making it a compound of two Words, *Calx* for *Lime*, and *Ciner*, *Aſhes*, which in a metallick ſence, is to reduce *Metals*, by *Fire* to a *friable* or *brickle* temper, like *Lime*; therefore *Lime* is called

onely in Latine, *Calx*, and we from the word call our *Lime-stone*, *Chalk*, which being burnt, we call *Lime*, and this burning we call *flacking* (according to the Teut.) and before it is *burnt*, *Unflackt*, *unburnt*, or *uncalcin'd Lime*; and being *burnt* or *flackt*, called alfo *Calx viva* (which is oft mentioned by our Author) and A. *Quick-Lime*, or that which hath by *Fire*, as it were) an additional *Life*, for metals feem to be dead in their *Oars*, but by this *Calcination* revived, to hint to us the advantages of our *Refurrection*, by the general *Conflagration*. 'Tis true, there are other ways of *Calcination*, efpecially of *Metals*; *viz*. by *Corrofion*, *Immerfion*, *Amalgamation*, *Cementations*, *Fumigations* and *Illinations*. (See *Salmon*.) yet none of thefe can be performed without Fire: but to return to the common *Lime*, as it is fitted for the ufe of *Architecture*, it is mingled with *Water* and *Sand*, and then called *Mortar*, and according as the *Lime* and *Sand* are in goodnefs, fo the *Structures* by it are made more durable, and therefore it is thought, That we had all our *Sand* for our *Mortar* (with which our antient Churches were built) out of *Italy*; and the *Fort* of *Plymouth* (built by his prefent Majefty) recompenfed my Journy thither, the *Graff* of which is hewn out of *Marble*, and the *Mortar* alfo made of *Calcined Marble*, and their *Sand*, which makes that *Mortar* as compact as the *Marble* it felf, but what kind of *Sand* or what *Proportions*, I did not then enquire. Now there are two words in L. which pafs under the fame *Orthography*, *viz*. *Calx* for *Lime*, and *Calx* for the *Heel* of a man, (or end of a thing) fo as I may conceive that our *Metallick* and *Artificial* word *Calx* for *Lime*, is borrowed of the Natural word *Calx* for Heel, becaufe the *calcining* of *Metals*, do as it were determine its Life for a better, becaufe thofe Metals which lay dully in the Earth, before their *Calcination* are by *Calcining* and *Refining* made more active and paffable throughout the World.

CALAMINARIS, See Brafs, and Sculpt 35.

CA-

CALIFY, T. *Warme, Werme,* L. *Calefaccre,* A. to make warm.

CALX, See Calcine.

CAPUT MORTIS, (for brevity *Mort.*) is the matter or ſediment of *Metals* (or of other things uſed in *Chimical Diſſolutions*) which remain at the bottom of a *Furnace* or *Stillatory, thick* and *dry,* chiefly from *Metals* and *Minerals* ; *viz.* when all their *Spirituous parts* are drawn off, the remainder is call'd *Caput Mort.* or *Feces.* See Feces.

CARRAT (ſignifying a weight) is a *French* and *Italian* Word, much uſed by our Author in his ſecond Book ; and it ſeems to come from the *Arabian, Kirat:* (ſee *Holioak.*) but *Cotgrave* ſaith, That *Goldſmiths* and *Minters* eſteem it at a third part of an *Ounce,* and among *Jewellers* and precious *Stone-cutters,* but the 19 part of an *Ounce;* ſo as eight of them are but one *Sterling,* and a *Sterling* is the 24*th.* part of an *Ounce,* and 3 *Grains* of *Aſſize,* or 4 *Grains* of *Diamond* weight make a *Carrat.*

Torriano's Addition to *Florio,* calls it *Carrato,* ſignifying, ſaith he, a weight or degree in *Metals, Diamonds, Rubies,* &c. and doth not determine it : but Mr. *Howel* in his ingenious *Tetraglotton* (ſect. 40.) proportions it to the 24 part of an *ounce,* and Mr. *Webſter* in his Hiſtory of *Metals* ſpeaks more clearly, and ſaith, the *Carrat* or *Charrat* is a term given (by the *Officers* of the *Mint,* and Wardens of *Goldſmiths*) to a certain compoſition of Weights, that are only uſed for *Aſſaying,* and computing the *ſtandard* of *Gold,* and are of two Contents, namely, *either* the 24 *part* of an *ounce* , *Troy-weight,* and is compounded thus; of the pound *carrats* 2 *d.* weight, and 12 *grains, Troy,* make a *Carrat grain,* and 4 ſuch *carrat grains* make one *carat,* which is half an *ounce,* or 10 *d.* weight *Troy,* and 24 of ſuch *carats* make a *pound* or 12 *ounces Troy,* the other way of Computation is of an ounce *carat,* five *Troy grains* make one *carat grain,* and four of ſuch *grains* make one *carat,* and 24 ſuch *carats* make one *ounce Troy,* and

for

for *aſſaying* he recommends the *ounce carat*, as more eaſy for *Calculation*, than the pound *carot*, which is made more perſpicuous by our Author. *l.* 2. *c.* 15. *See* Mony, Gold-weights.

CASE, *T. Gebaueſz*, or a little houſe, L. *Capſula. A. Caſe*, 'tis of various ſignification, as, a *Gramatical, Legal, Formal*, and ſometimes put for an ill *chance* or hard *caſe*. See *Sculpture* 1, 5, 12, 13.

CATSILVER, *T. Kat-zon Silver*, becauſe it hath a grey *ſparkling* colour like a *Cats-eye*.

CEMENT, *cementing* and *Cementation*. T. *Cementerne*. L. *Cæmentum*, not from *Cædo*, to beat (as *Minſhaw* would have it) but *Cæmentum*, is *quaſi mens cæli*, i. e. the mind of Heaven, to *unite* things ſeparated, eſpecially, when they conſiſt of one *ſpecies*, and it may well be obſerved in the viciſſitute of the things in the World, that the whole Labour of *Man* and *Nature*, ſeems to be almoſt nothing elſe, but to *ſeparate* what is *united*, and to *unite* things that are *ſeparated*, and this not only ſeen in our *operations* upon *Metals*, but in the actions of *humane Affairs*: yet, to paſs them by, this *Cementation* of *Metals* is properly a gradual *imbodying* or *uniting* of *Metals* firſt ſeparated, and this by a *gentle* fire, as in *Lib.* 1, 2, and 3 Books, wherein there are ſeveral magiſterial *Directions*: and in other Caſes 'tis properly called a *Conglutination*, or *glewing together*. *See* Conglutinate.

CENTNER, *T. Center* & *Centner*. L. *centum*. At the *Mines* it ſignifies an *hundred* and *ten pounds* weight, but at the Mint, juſt an hundred pound: Whereby the *Miner* may get 10 *l.* towards his charges: See *lib.* 1 *cap.* 9. but in *lib.* 1. *cap.* 37. and in many parts of the five Books, it is conſidered only as a ſmall *Aſſay-weight* for trying how much a little Part of an *hundred weight* do hold of *Gold, Silver*, &c. whereby (as *ex ungue Leonis*, the whole Proportion of the *Lion* may be known from its *claw*: ſo by the ſmall *Aſſay weight*, the goodneſs of the whole piece may alſo be eſtimated, be it a *centner* or *half* a *centner*, &c. and this ſhews the skill of an *Aſſay er* in the skilful uſe of *Arithmetick*.

CE-

CERUSE. T. *Bleywiesse*, L. *Cerussa*. A. *White Lead*, the best is made of *Lead*, calcined with the *vapors* of *Vinegar*; but the common way is by *Urine*.

CHRISTAL, T. *Keistal*, L. *Christalus* and *Christalum*, there is *Natural* and *Artificial*, the *Natural* is *Aqua quæ frigore in glaciem concressit*; that is, congealed or petrefied Ice. *Diodorus Sic.* and *Boetius* are of a contrary Opinion, and say, It is the *purest Earth*, dissolved by *Water*, and for want of *Water*, *congeal'd* to the *Christal-Stone*: 'tis found about the *Alps* and in many parts of *Germany*, *Hungary*, *France*, &c. And Captain *Ant. Langston*, my good Friend, who had travelled about 300 Miles into the Continent of *Virginia*, did assure me, that he saw there several Mountains of *clear* and *shining Christal*; he died about a year since, and was a very Credible person whilst he lived. Now the Artificial *Christals*, are made by *Chimistry*, and is a peculiar part of that Science, called *Christalization*; that is, making things like *Christals*: *viz.* *Christal* of *Silver*, *Tin*, *Antimony*, &c. See Petrefaction and Stone.

CHIMISTRY, see *Alchimy* and *Alchimist*: But I have something more to say to them, for I find that the *Chimist* hath another Name, and is called *Spagirus*; and *Chymistry*, *Ars Spagerica*; signifying, to *fine* and *refine Metals*, and therefore I have thought fit to put the words *Spagericæ Leges*, as the Title to this *whole Treatise*, instead of *Leges Chymicæ*, this latter being more commonly used than the other: nor do I wave the word *Alchimy* or *Alchimist*, because it is sometimes taken in an ill Sense, for in the best and truest Sence, by the addition of ALL (which word in all Languages signifies *Omnia*) so as by addition of All, we are to understand, That *Chymistry* doth comprehend All Sciences and Mechanick Arts and Trades, even from the *Coblers Awl* (T. *Aal*, and *Belgick Elsen*) to the *Astronomers Astralobe*, for nothing can be performed without some Metalick Instrument.

CINABAR, T. *Zenober*, or (*l.* 1. *c.* 2. *f.* 5.) *Bergennouer*,

L. *Cinnabaris*, which in *English* we call natural *Vermillion*, for of this *Cinnabar*, there are two sorts: *Natural*, which is an hard, red and heavy Stone, found in *Mines*: or *Artificial*, which is better coloured (made of *calcin'd Sulphur* and *Quick-silver*, which we now use with Metals) but it is vulgarly called *Ruddle* or marken *Stone*, and *Sinople* or *Red Lead*; the first also of these two is *natural*, and the other *artificial*, but I conceive our *Author* intends none of these latter, but the former, or one of them. *Pliny*, *N. H. l.* 33. hath a large Discourse of this *Cinabar*, and makes it the same with *Minium*, of a rich and fresh Scarlet *Colour*, and saith, there are whole *Mines* of it in some parts of *Spain*; and concludes with his Opinion, That it is the *Rust* of *Silver* and *Lead*, but it hath not the less Esteem with the best *Painters* or *Limners*, no more then hath *Verdigrise*, though it be the *Rust* of *Copper*: there is great quantity of this *Cinabar* in the *Mines* of *America*, and some few *Veins* of it, in the *English Copper-Mines*. See Gold and Quick-silver.

CLAR, so the T. word is writ (*l.* 1. *c.* 5. *f.* 1. and *c.* 7. *f.* 1. and *c.* 21.) the *French* call it *Clair*, and A. *Clear*; Now though this word bears the same sence in all, yet because, by a certain composition, it doth *clear* the *Metals* and *Instruments* to which it is applyed (for distinction sake) I think fit, according to the T. to call it *Clar*, as a *substantive*, rather then *Clear*, which for the most part is used as an *adjective*. viz. *clear Drink*, &c.

CLAY, T. *Laim* and *Thon*. *l.* 2. *c.* 20. *f.* 1. &c. But the L. calls *Clay* (which is of a flat and clammy Earth) *Argilla* and *Terra Figulina*, because *Potters* (by whom it is used) do reduce it to certain *Figures*; in A. it is commonly called *Potters-Earth*, or *Clay* for making of *Potts*, *Dishes*, &c. and although *Erckern* applyes the word chiefly to *Potters-Earth*, *Clay* or *Loam*, yet there are many other *Clays* or *Earths* which have particular *Names*, according to their *natures* and *colours*; as *Fullers-Earth*, or *Clay* of a *Russet colour*, also *Blew*, *Green* and *reddish clay*, but that which is for common use is *solid* and *firm*, and for the most part of a *russet* or *blewish Hue* or *colour*:

and

and though it be ſaid by *Minſhaw*; That *Potters Clay* is called *Argilla*, from *Argos* a City in *Greece*, where *Potters* (as he ſaith) did firſt exerciſe that *Art* (which *Pliny* aſcribes to *Coræbus* an *Athenian*, one in the Province of *Argolis*, and the other in *Africa*, but both in *Greece*:) ſo it ſeems the *Art* was there, before it was in *Ægypt* in *Africa*: however, according to the Sacred Story, the *Art* of making *Pots* of *Clay* was antient, as we may read in *Exod.* 16. 13. and of *Bricks*. *Exod.* 5. 8. and in *Job* 4. 19. the *Houſes* in his time were called *Houſes* of *Clay*, and *Clay* was of ſuch Eſteem with *Jeſus Chriſt*, That he made it an Inſtrumental cure in the Blind Man. *Jo.* 9. 6.

Now to paſs theſe, In *Devonſhire*, and other places, I have ſeen good *cottages* made only with *clay*, without any wood, except little *Window-caſes*, *doors* and *roofs*; and in *Suffolk* and *Norfolk* the outſide of moſt *cottages* and *out-houſes* (to great edifices) are of *clay* daub'd on Splenters,and the inſides alſo *plaſtered* with *clay*, and a little *Lime*, yet are very durable.

At *Woodford*, near *London* (about 20 years ſince) I ſaw a fair Houſe of *Brick*, built on the top of that hill, and had no *lime* or other *mortar* within or without it, but ſound *clay* mixt with *ſand*, which continues ſtrong to this day, as I am informed: and in 1674. (my Houſe in *Suffolk* (ſtanding on an Hill, upon a *clay Soil*) I digg'd about 30 foot in length, and 10 foot deep, under part of it, with intent to make a *cellar*, deſigning to *pin* or *ſupport* the ſides with *Brick*: But finding the *clay* to be very firm (being mattocked and not ſpaded) and never before digg'd (as might be judg'd, becauſe under the *clay* was found good *gravel*,and beds of flat *Oyſter-ſhells*) I ſaved the charge by continuing the *clay* in ſtead of the *brick*, and I hear it doth hold firm to this day, as if it had been done with *Brick*: and doubtleſs,according as the *clay* is in goodneſs,ſo *Furnaces*,*Ovens*,*Teſts*,*Crucibles*,&c. will the better indure the *heat* of *Fire* and *Metals*: care being taken that they be

be well dryed, after they are made,and before they be exposed to the fire, and then by degrees, and not suddenly burnt. See Brick, Earth, Loadstone.

COAGULATE, T. *Renſel*, L: *Coagulatio*, See conglutinate.

COAL, T. *Koll ſtein*, L. *Carbo*, of theſe we have Varieties, *viz*. *Wood-coal* (of ſeveral ſorts mentioned by our *Author*) uſed chiefly for *Metals*, Sea *Coal* (dig'd out of *Coal-Mines*, near the Sea at *Tinmouth*, by *Newcaſtle*, and *Pit-Coal* (in Mines remote from the Sea) near *Coventry* in *Warwick-ſhire*, and in *Stafford-ſhire* and *Shropſhire*, &c. but theſe are not uſeful to *Metals*: 'tis true, many have attempted to *Chark* or make *Cinders* of them to be uſed for *Metals*, when Wood is ſcarce, but I have not yet heard of any certain ſucceſs therein (though I wiſh it:) there is another *Coal* which is artificial, which we call *Charcoal*, and I conceive the proper Latine word for it is *Anthrax*, and the burner of it *Anthratius*, but moſt Dictionaries do uſe *carbo* and *carbones* for all ſorts of Coals, by adding *Adjectives*, as *Carbones Foſſiles*, &c. but *Charcoal* being a new Invention (comparative to the other) it is fit to have a newer word then *Carbo*, and theſe *Charcoals* of Wood, are moſt uſeful for *Metals*: Now in making thoſe of *Wood*, the *Art* is ſo much improved, that I have ſeen an *Arrow* with its *Feathers* exactly burnt into a *Charcoal*, without diminution of the *ſhape* or the *Feather*, only the Feather made *black* for *white*, and ſome of this Wood *Charcoal*, I have ſeen at the *Iron-Mills* in *Worceſterſhire*, ſo *uncombuſtible*, that they have come running out of the *Furnace*, and *floated* on the top of the *Metal*, *whole* and *intire*, and this (as they told me) was the *Charcoal* of the *Withy-Tree*, being a more light and ſoft Wood than any that grows in thoſe parts: I carried away ſome of them, and cut them into fine *Pencils*, and uſed them for Drawing, on blew *Paper* (eſpecially being firſt boyl'd in *Butter*) and the white *Pencils* proper to them, I made of *Tabacco-Pipe Earth*, in *Rouls* dry'd by the *Sun*, and not at the *Fire*, and ſometimes I heightned the lights with *Ceruſe* (compoſed of *Lead*, ſee *Ceruſe*.)

CO-

COBOLT, T. *Cobolt.* Sometimes accounted for the *Copper-ſtone*, and reckoned by Dr. *Salmon*, among the natural *Recrements of mettals*; and I do not find it by any other name, then as it is ſo deſcribed by *Erckern. l.* 1. *c.* 2. *ſ.* 11. & *l.* 3. *c.* 21. &c.

COIN, T. *Gemuntſz*, the Latine hath ſeveral Words for it, *viz. Moneta, Nummus, Pecunia*, &c. and *Aurum, Argentum, Cuprum, Æs*; and antiently *Coriata* (when *Leather Coin* was currant and in eſteem) but the proper word for it, (and ſo *Minſhaw*) is *Cuſus*, thence *Cudere* to *Coin*: Now *Moneta* is a relative Word to *Monere*, adviſing to take heed how to uſe Mony, only to honeſt ends, after it is once Coin'd: *Nummus* to *Numeratus* or *Quantity*: *Pecumia* to *Pecus* or *Sheep*, which were and ſtill are commutative as *Money* it ſelf, but it may be properly from the *Greek* Word *Kainos*, *Comunis*, becauſe when it once had its *Stamp* or *Cude* upon it, then it was paſſable, currant and Common, and ſome would have it from the form of the *Coin*, conſiſting of *Angles* (as much of the *French* and *Spaniſh Mony* do) and ſome ſay, That from Angular Coins, the Corners or Angles of Structures are called *Coins*, becauſe with ſuch Mony the *Architects* were paid their Wages. Now, I conceive that I may add my Suppoſition alſo, That the Word *Coin*, may be the abſtract of *Coynobeline* or *Cunobeline*, one of the *Kings* of the old *Britans*, and who is ſaid to be the firſt that did *coin Mony*, at *Malden* in *Eſſex* (*Cambden*) where it is probable that their *Mines* (in our Records) ſince decayed or neglected, did ſupply him with *Metal*, for that purpoſe; however, in our later Ages, the Word *Coin* is ſtill applyed to *Metals*, formed into *Currant Mony* made of *Metals*.

CONDENSE, T. *Dick-Maken*, A. making *Thick*. L. *Condenſatio*.

CONGEAL, *ver Breizon*, L. *Coagulatio*. *See* Conglutinate.

CONGLUTINATE. T. *Lime*, (from whence we have the word *lime*, for a Dog and Bitch in copulation) L. *conglutinare*.

glutinare. A. to glew and join together: now these words *cement, coagulate, condense, congeal* and *conglutinate* are often, but improperly, applyed to one sense, especially about *metals*; for *cementing* is, as I have shewn in *Cement*; *coagulation,* from *coagulo,* to *curdle,* i.e. where *metals* are *joyned* or *curdled* together by fire; *condensation,* when *metals* are made more *hard,* or thickned; *congelation,* when they are by Fire turned into a *Christaline, Glittering* and *Icy form,* from *gelare,* to turn into *Ice*; which kind of *Christal* is often seen in *refining* of *metals*; and *conglutination* from *Glutinare,* when they are joyned by a *glewish temper,* and is more properly applicable to vessels made of *Glutinous* matter, for the better holding of *Metals* in the Fire, yet all these Words still signify the making of things *thicker* or *harder,* than they were before: Now as to *Conglutination,* I cannot here but call to mind what I saw at *Exmouth* in *Devonshire,* where upon little Rocks appearing somewhat above the *Sands* (at a low Water) there were *Oysters* sticking fast to them (which at an high Water were all covered by the Sea) so as we were forc't to beat them off with a Chizel and Hammer, and these they call'd *Rock Oysters,* the *Shells* being almost as firm as the *Rock* it self; I confess I look't upon it as a wonderful *Secret* in *Nature,* That the *Oyster* could fix it self so firmly, having no outward parts to do it, and this in 12 hours time; for at the next *Low-Water* those very *Rocks* (where at the former *Ebb* we had left no *Oysters* on them) they were filled again with other *Oysters,* and therefore it must be some *glutinous* matter, which they cast forth upon the *Rocks,* and so brood upon it to a *condensation*; and I the rather believe this, because *Shell-Snails,* which we call *Dodmans,* have an excellent white *Cement,* always lying in the little end of the *Cone* of their *Shells,* with which they often glew themselves so fast to Walls, that they cannot get loose, but dye in their *Shells*: and so do's the *Limpet* (another *Shell-Fish* on the same *Coast*) cleave it self so hard to the *Rocks,* that nothing but a *Chizel* can divide them from the *Rocks*; now cer-

certainly, if that part of the *Oyster-shell* which is so *glewed*, were mixt with so much of the *Rock*, on which it is fixt, there might be made a very *binding Glew* or *Cement*, for *Metallick Vessels*; but there is another sort of *Shell-Fish*, upon that *Coast* also, which I cannot but mention, because I do not find it amongst those that write of *Shell-Fishes*, and it is called in that County, the *Long-Fish*, or *Capa Longa*, the longest are not above 12 Inches and about an Inch in breadth, opening at each end, and contains in it a *white-Worm* (for I cannot call it otherwise) which is a very nourishing Food, and being pickled up, are sent as acceptable Presents, to those that make their Gusts their delights; these are caught in this manner: at a *Low Water*, that is, when the Sands are clear of Water, those Fishes do shew themselves above the Sands, about 3 Inches, so as 8 or 9 Inches remain in the sands, and then those who make it their Trade to get them, presently go against the wind very softly (as in catching of *Moles*) and with an Iron Engine (somewhat like a *Spade*) strike under them, and so are caught; but if they go with the wind, the Fish presently retires into the Sand, without possibility of being caught for that Tyde, and though after their Escapes, I have seen them digg'd for, yet they vanish beyond the strength or agillity of labour to catch them.

Now, these having no outward thing discernable to assist them in so quick a Motion, I conceive it must be by some glutinous matter, (such as we see do attend snails in their motion, but the snails cannot contract it again, because it usually lies on some dry substance) but the glutinous matter of these *Capa longa's*, being fixt in their Repositories (much under the *superficies* of the sand, and so extended by them like a *spiders thred*) may with much more agility than a *spider* rise or fall as they please in a moment, there being a liquidity from their Repositories to make their motions of ascention or descention more agile and passable: Now from Creatures of this constitutions, certainly many excellent *Cements* may be made, as may be judged by the Fish, which *Pliny lib.* 32. *cap.* 7. calls

Itch-

Itchthiocalla, and we *Ising-glass* Fish, which besides other virtues, the skin and other parts of it (as he tells us, and now we know by Experience) do make an excellent *Cement* (especially if it be mingled with *aqua vita*) either for earthen Ware or Metals: enduring both *fire* and *water*.

COLOUR, T. *Farb.* L. *Color.* A. *Colour.* (signifying *Beauty* or *Pulchritude*) of which there are two sorts: *natural* and *artificial*; wherewith the *Limners* and *Painters*, in Imitation of the Beauty of *Nature*, shews us the Beauty of their *Art*; yet they cannot perform their Works without the help and mixture of other *Substances*; as *Oyls*, *Gums*,&c. but their best and most proper *Colours* are from *Metals*; Whereof *seven* are accounted the chief, produced from the seven *chief Metals* which are influenced from the *seven Planets*, and these 7 *Colours* are used in *painting*, by two sorts of eminent *Artists* in that Science, *viz.* those who use them with *Gum* (call'd the Art of *Miniature* or drawing in little) and those which use them with *Oyl* (called *Limners* or Painters, or drawing in great and little) for I meddle not with those who work with *Pastils* or in *Frisco*, or *Dyers*, or *Tincturists*, so the first of these in an *Alphabetical* Order is *Black*; otherwise *White* and *Black* are accounted the *Principes Colorum*, & *Mensura Reliquorum* (Alsted.) And all of them produc'd from Metals and Minerals: the *Seven* are these;

I. BLACK, T. *Schwartz* (*l.* 1. *p.* 6.) from whence we have our word *swarth* or *swarthy*, inclining to *black*) L. *Niger.* *Plutarch* calls it *color umbrosus.* A. *Black*, and these *Blacks* are natural in *Stones*, *Coals*, &c. but the best *Artificial ones* are made by the *retortions* of *Lamps*, placed under *Plates* of *Gold*, *Silver*, *Copper*, *Lead*, *Tin* or *Iron*, and are easily distinguish't, in their *nigerities* or *blackness*; and this shews, that black hath some superiority over *white*, because when *white* things, as *Ivory*, &c. are burnt, they turn to a *black*: but as to our purpose: it is Observable, That all these

Blacks are ſtill heightned and improved for uſe, by the three eminent *Minerals*, viz. *Vitriol*, *Allum* and *Copperas*.

II. BLEW, T. *Blau* and *Himmel Blau* (in *Engliſh* heavenly Blew) the *Latines* renders it to us moſtly by *Participles* or *Adjectives*, as *Lividus*, *Adluens*, *Cæruleus*, *Cyanæus*, *Cumatilis*, *Cœleſtis Color*: that is, a Colour having thoſe properties or reſemblances: the *French* calls it *Bleu* and *Azur*, and we *Blew* and *Azure*, we from them, or they from us; which latter is the more likely, becauſe we have more *Mines* of *Copper*, from whence it is produced, than they: now beſides this *Azure Blew*, there is *Blew Biſe*, *Ultramarine*, *Smalt*, *Flory*, *Inde-Bandias*, *Litmus*, *Orchal*, *Blew Vitriol*, *Verdigreaſe*, produced from *Mines* and *Minerals*.

III. BROWN (or *Ruſſet*) T. *Braun*, the *Latines*, which would bring this into the *ſeptinary* of *colours*, call it *color nativus* and *Pulligo* (*Holioke*) otherwiſe the common name is *Fuſcus*, from the darkneſs of its *colour*, being (as it were) an attendent on *Black*, and of this *brown colour* (which is the proper colour of *Tin* and *Copper Oar*) there is *Umber*, *Spaniſh-Brown*, *Terrra d'colonia*, *Turnſil*, *Bole Armoniack*, and other *products* of *Metals* and *Minerals*, which *Painters* and other do uſe for it.

IV. GREEN, T. *Gruen*, L. *Veridis Recens*, and many other words relating to the diverſity of *Greens*, but thoſe which are uſed for *Painting* (from *Metals* and *Minerals*) are *Green Biſe*, *Virditer*, *Verdigreaſe* (which though it be uſed for *Blew*) yet being ſteept in *Vinegar* (as I have oft tryed) it doth produce a delightful *tranſparent Green*: alſo *Copperas*, *Vitriol* and *Allum* do much improve this colour.

V. RED, T. *Rot*, L. *Ruber*, *Rufus*, &c. to ſupply which for *Painting* (there is *Lake*, which is another delicate *tranſparent red purple colour*) alſo *red Lead*, *Vermillion*, *Cinnabar*, *Minium* (of different Names, yet little differing in colour)

alſo *Cinople*, *Roſſet*, and ſeveral other *Reds* from *Metals* and *Minerals*.

VI. WHITE, T. *Weitz* and *Blanch*, L. *Albus* and *Candidus*, to repreſent this, the *Painters* uſe *Littarge* of *Silver*, *Ceruſe*, *white Lead*, *Spaniſh White*, &c. raiſed from the *Calcination* of *Metals*.

VII. YELLOW, T. *Gelb*, L. *Gilvus*, *Flavus*, *Fulvus*, *Luteus*, *Croceus*; to repreſent this, they uſe *Littarge* of *Gold* (and a liquid matter which counterfeits *Gold*, ſuch as is uſed about *Coaches*, &c.) they have alſo *yellow Orpiment*, *Sandarach*, *Maſticot*, *yellow Oker*, &c.

Now of theſe *colours*, thoſe which are produced from *Metals* and *Minerals* (as I have ſhewn) are too *piercing* for *Paintings* with *Gum*, and therefore not *laſting*, but with Oyl they are *ſafe* and very *durable*, even to a *thouſand* years or more, eſpecially in the curious Art of *Anealing*.

Now concerning *colours* in general, here is the difference between the *Botanick Science* and the *Metallick*, becauſe in one the *colour* of *Plants* are ſeen in their admirable *varietys*, *without* the uſe of *Art*; but the *colours* of *Metals* are not ſeen, but by the help of *Art*; only it may be ſuppoſed, that every *Vein* of *Metal* hath ſome *pretious Stones* to attend it, whereby we may be informed of what colour that *Metal* is moſt apt to yeild by *Art*: as *Saphires*, *white* and *yellow*, *Diamonds*, *Rubyes*, *Emeralds*, *Amathiſts*, &c. which are daily found (eſpecially in hotter *Climates*:) there are alſo other *colours*, mentioned by *Erckern*, as *Grey*, *Lazure*, *red Sulphur*, *Purple*, *Orange*, &c. but whoever will make a more exact *review*, will find, that the moſt *pleaſing*, *uſeful* and *durable colours*, are from the *Metals* themſelves, or their *Extracts* and *Flowers*, ſeen in their Original repreſentatives, *viz*. *Gems* and *pretious Stones*.

CO-OPERATE. T. *mit eyn ander werk*. L. *Co-operate*, to work together, that is, when Metals do work together before ſeparation, and is alſo generally applyed to any joynt action.

COPELLS. See Utenfils.

COPPER, T. *Cupfer*, L. *Cuprum* (*l.* 3.) A. *Copper*, and is accounted the third Metal in efteem next *Gold*; and, as is pretended comes from the Ifle of *Cyprus*, from whence it had its Name *Cuprum*; we need not go fo far for it, having many Mines of that Metal, both in *England* and *Wales*, efpecially thofe at *Kefwick* in *Cumberland*, , which occafioned a great *Suit* betw.en Queen *Elifabeth* and the Earl of *Northumberland*, concerning her Right to them, upon the account of *Royal Mines*: which Cafe is reported by *Plouden*, with the Opinion of the Judges on the Queens fide, wherby the *Society* for the *Mines Royal*, have had and ftill have the care over them, but for want of *Fuel* and skilful *Miners*, they are of no ufe at prefent: This *Metal* is of three forts, the *Red* or *Reddifh*, is the proper *Natural Copper*: *Yellow Copper*, which, for diftinction, is properly called *Brafs*, is an *Imitator* of *Gold*: the *White* is when *Copper* is tinged with *Silver*, fo as it imitates *Silver*. See Brafs.

COPPERAS, T. *Vitriol*, L. *Vitriolum*, this is a kind of Stone which is caft up very plentifully between *Rochefter* and the *Ifle* of *Shepy* (which being not far) I went purpofely to the *Copperas-Works*, farmed of Mr. *Haward* (Lord of the Soyl) by one Mr. *Johnfon* a *Londoner*, who in few years got above 20000 *l.* by it, as appeared by what he left to his two Daughters, when he died: I went alfo to other places, but did not find that the Stones are fo plentiful and good in any other place of *England*: it is of a dark *Sea-Green*, but being melted its colour is heightned, and glitters like to *Chryftal*, and ferves for many ufes about Metals, and almoft in all *Trades* where *colours* are concerned; and is one of the chief Ingredients for good *Ink*, as I found it in an old *Abbot*'s Book:

Vitrioli quarta, mediata fit uncia gummi;
Uncia fit Galli, his jungas octo Falerni; (which I take to be Sherry)
His bene contritis, comixtis omnibus illis,
Facit bonum Atramentum.

And

And therefore this *Copperas* or one ſort of *Vitriol* (in diſtinction of the white (called *Dans* Vitriol, becauſe from *Denmark*) and the perfect *blew Vitriol* (called *Roman*, coming out of *Italy*) is called *Atramentum Sutorium*, becauſe *Shomakers*-black is made with it. See *Colours*, Black *and* Vitriol.

COPPER-ſtone, T. *Ruffer ſtein* (lib. 3.) is no other than ſolid *Oar* of *Copper*, as it is in the *mine*, and not touch'd by other Imbracers, or, as it is made at the firſt *ſmelting* into Cakes or ſtones, and ſo the word *Stone* is commonly applyed to it by *Erckern*. See *Oars* and *Stones*.

CRISTAL, *See* Chriſtal.

CROCUS, is the T. and L. for *Saffron* (lib. 2. and 4.) but in *Metallicks*, it is meant a pouder made of *Iron* or *Antimony*, of a *Saffron colour*, and when it is made of *Iron* it is called *Crocus Martis*, or of *Copper*, *Crocus Veneris*, becauſe it is the pouder of thoſe *Metals* of *Iron* and *Copper*, which are Dedicated to the *Planets Mars* and *Venus*, and ſometimes is made of *mixt Metals*, and then called *Crocus Metallorum*, and are often mentioned by our Author.

CREIZER (*l.* 2. *c.* 2.) T. *Kreutzer* from *Kreutx*, or a little *Croſs* ſtampt upon it, and is ſo ſmall a piece, that it is accounted but the 92 part of an *Hungarian Gilder*, which is about 30 *pence* of our Silver: but *H. Vaughan* in his Book of *Coinage*, makes ſix ſorts beſides the *Hungarian*. See VVeight.

CRUCIBLE, T. *Tiegel*, I find no proper Latine Word for it, but it may go under the word *Phiala* for a *Cruiſe* or a *Pot*, and this *Crucible* is a diminutive of *Cruiſe*, or *Pot* leſs than a *Cruiſe*, but of different ſhapes: and this is uſed for diſſolving of ſmall pieces of *Metal* for *Aſſaying*, as others are for other uſes called *Cruiſes*. See Pots.

CULB, T. *Krug*, which is a common name for all *Cubical Pots*, but we call it *Culb*, from the particular form of it, I ſuppoſe, becauſe it inclines to a *Cubical* ſhape. See Sculpture.

DE DI

DEAD, T. *Todt*, *Todter* (from whence we have our word *Tclod* or *Clod*) and *Geſterbeu*, L. *Mortuus*, *Defunctus*. See Diſſolution.

DECLINATION, T. *Niderſichbiegn*, L. *Deorſum ſe flectere*, and is almoſt the ſame with *Precipitation*; for which *Gramarians* uſe the Word *Declination*, *Declenſion*, or going from one *Caſe* to another, and in the Vulgar ſence, a man is ſaid to *decline* in his Fortune, when he falls from *Proſperity* to *Adverſity*: but in the *Metalick* ſence, it it to fall from the *top* to the *bottom*, by which means the *Metal* is better than when it was at the *top*; and 'tis often ſeen that *adverſity* makes Men better and of more uſe (as *Metals* are) by being Caſt down; a *Phraiſe* often uſed in this Book. See Precipitation.

DEFT, (*l.* 1.&c.) an *Engliſh Saxon Word*, therefore I retain it; ſignifying *fair*, *clean*, *neat* (*quaſi ſine defectu*) or without defect, on the contrary *undeft* is *unclean*, &c. (*Skinner.*)

DELINEATE (*l.* 2.) or to *Deſcribe* a thing by certain *Lines* or *Figures*.

DIAMETER (*l.* 1.) is a certain ſtraight *Line*, drawn through the *Center* of a *Figure*, and of both ſides bounded in the compaſs of it, cutting or dividing the *Figure* into two equal parts.

DISHES (*l.* 1.&c.) T. *Schueffels*, L. *Diſcus*, A. *Diſhes*, and theſe are of various ſorts and ſhapes, but the moſt uſeful about

Metals are made of *Pewter*, *Iron* or *Clay*, for I do not here write of *Epicurean Dishes*, but of *Dishes* or *Bowls* that are certain *measures* in *Mines*, which are filled with *Oar*, by the Labour of the *Miners*, whereof a certain number are paid as a *duty* to the King, others as a *duty* to the *Church*, and the rest to the *Proprietors*, and according to the number of *Dishes* delivered, so the *Miners* are paid; and then they may eat the *Fruit* of their *Labour* in other *Dishes*. See Utensils and VVardens.

DISSOLVING (*l.* 2. *&c.*) that is, a *metal* easy to be loosed from such other *metals* as are fixt or intermixt; and thence *Death* is called a *Dissolution*, when the *Soul* is loosened from its *Terrestral part*, and becomes a *Cœlestial Metal*, and from hence the word *Dead* is oft used in *Erckern*.

DISTILLATION (*l.* 2. *&c.*) is a drawing of a *Liquor* made thin with *heat*, into a *Receiver*, by *Alembicks*, *Retorts*, &c. and is mentioned by our *Author*, though of little use to *Refiners*, who deal with hotter *fires* and harder *substances*.

DRAGGONS-BLOOD, L. *Sanguis Draconis* (*l.* 2. *c.* 13.) our *Author* useth it for *Lutings*. Dr. *Salmon* saith, It is the product of a *Tree*, red like Blood, or the colour of a *Dragon*, and comes to us from *America*, and by boyling condensated: but *Pliny* (*l.* 36. *c.* 7.) saith, That the *Indians* make it of the *substance* of a *Dragon*, crush't and squiez'd with the weight of an *Elephant*, falling upon a *Dragon*, that hath suck't him to *Death*, whereby the *Dragons* and *Elephants Blood* are mingled together; and of this the *Indians* make a *Colour* like *Cinnabar*, so as though they bear one name, they are of different Natures, and which it is that *Erckern* means, I leave it to others; for the Blood of the *Ox*, &c. we see in other of his *Experiments* is used in *Luting* and *Cements*: there is also an *Herb* growing plentifully in *England*, called *Dragons Blood*, which is much used to *tinge Colours*, and hath a *Restringent quality*, and so may be used with *Clay* in *Lutings*.

DRAM (*l.* 1. *&c.*) T. *Quintlein*, L. *Drachma*. See VVeight.

DREGS,

DREGS, *T. Truffen vapfen*, L. *Fæx*, from whence we ufe the Word *Feces*.

DRIVE *or* *Driving*, T. *Abtreiben*, L. *Abigere*, *Depellere*. *l.* 3. *c.*25.) fignifieth the forcing of *metal* to caft its *drofs* upwards, as the *feces* downwards, *l.* 3. *c.* 25. & 26. and in many other places ufed.

DROSS. *T. Treufen*. L. *Fæx*. A. the *fcum* of *metals*: fee *Dreggs*, *Feces*, *Scorias*, *Lees*, *Slacks*, &c. fo it feems *Dregs* is the *purge* or *fettlement* at the bottom of *melted Metals*, and *Drofs* the *vomiting* the *crude* matter *upwards*.

DRY, *T. Abdoerren* and *Treigen maken*, *L. Siccare* (*l.* 3. *c.* 26.) *See* Ovens.

DUCCATES. *See* Money.

DUKE-GOLD. *See* Money.

DULCIFICATION, *T. Sufz*, *L. Dulcis*, or *reducing* the ill *Tafts* or *Scents* of *Metal* to *fweet* and *pleafing*; and thence the *Pouders* often are called both *Sugars* and *Salts*, as they are *different* by *Extraction*, and the *perfuming* of them called *Hedichra*, and thefe are difperfed in our *Author*, and are called *Saccharia Auri*, or the *Sugar* of *Gold*.

DUNG, *T. Tingen*, *L. Sturcus*, and of thefe *Horfe-Dung* and *Ox-Dung*, and fome other *Dungs* are a chief *Ingredient* to *Lutings* (ufed by our *Author* *l.*2. *c.*20. &c.) and the *Dung* of *Creatures* are not only ufed in this *Art*, but in almoft all other *Arts* and *Sciences*; by *Chimifts* called *Ignis Sapientum*, or the *Wife-man's Fire* (*Howel*) and though it be in contempt amongft *Ladies* (and the lefs *Learned* Inquirers into *Nature*) yet certainly the *Heathens* had them in fuch *Veneration*, that they *Sacrificed* to moft of their *Idol Gods*, upon the account of Stercorary Virtues in them: and therefore the *Tranflators* of our *Bible* into *Latine*, inftead of *Idols* calls them *Dij Stercorarij* (*Junius* and *Trem.*) of which I apprehend this reafon: *viz.* that the feveral ufes which they made of *Dung*, either for *Medicine* or *Manuring* their grounds, might be *propitious* to them: and I have read it from fome *Traveller* of *note*, That among the

the *Indians* it was usual, that when they intended *Homage* to their *Superiors*, or *welcome* to their *Friends*, they did *evacuate* their *Dung* into their *Hand*,and so daub it on the *Face* of whom they intended to *honour* or *pleasure*, and was ever accepted by them, as the *first* and *best* of their *Welcoming Ceremonies*: for *Agricola* tells us of *Mans-Dung* made as sweet as *Civit*. But to return nearer home, when I remained in *London*, during the great *Plague* in 1666. Dr. *Glisson* (famous in his time) being my old *Friend* and *Acquaintance*,perswaded me to take a piece of his constant *Antidote*, which was only the *Dung* of one that had dyed of the *Plague*, dryed, and so kept in a *foraminous Box*,for the best *Antidotical Perfume*; but I thank God I escaped without it: and let us but consider of the great Virtue of the *Dung* of *Geese*, *Ducks*, *Peacocks*, *Dogs* (generally known and used) it were worth the while to make a *Collection* of them, from *Johnson's NaturalHistory* of *Quadrupedes*, &c. and it may very well compleat a large *Book* of those useful *Experiments*; especially if a little variety from *Pliny* be admitted: so I will conclude with this Direction, That *Stone-Horse-Dung* is of certain and known Virtues in *curing scaldings*, *scorchings* or *burnings* by hot *Metals*, if quickly applied to the part grieved.

DUCCATE, T. *Duckat*. L. *ducalis aureus*. A certain *Gold coin* which was first coyn'd in *Rome*, *Anno* 547. and afterwards it began to be used in other Places, and so called because it had the Image of a *Duke* (that is, some eminent Leader of an Army, *à ducendo*) and worth about 6 *s*. 8*d*. *English*,now 9 *s*. (*Holiock*) This *Coyn* was held formerly the best *Gold*, but now it is much *adulterated*, so as *Goldsmiths* are very careful in receiving them.

DUST. T. *Staub*. L. *Pulvis*. See *Pouder*, *Ashes*, *Pulverising*.

EA EA

EARTH, T. *Erd*, L. *Terra.* A. *Earth*, from the *Saxon:* Now, in every *Territory* there are differences of *Earth*, ſo there are accounted *ſixty eight ſorts :* but of thoſe which are eſteemed the beſt in *England* (which other Nations make uſe of more than our ſelves.) ſome of them are rather *lapidious* than *fragile*, as *yellow Oker* (of which I have ſeen a *Pit* or *Quarry* in Mr. *Whorewood*'s grounds at *Halton* in *Oxford-ſhire*:) alſo *red Oker* (which ſome call *Marking-ſtone*) in many places, and both of theſe are improved by *artificial Okers*: and of *Fullers Earth* there is ſtore, and very good, in a Lordſhip of the Earl of *Bedford*'s, near *Oburn-Abby*; alſo in Sir *John Warren*'s ground in *Suffolk*, and in many other parts of *England*; (of which the *Dutch* make good uſe, though there is a Law to the contrary.) As for *Chalk* which is burnt into *Lime*, and *White Earth* for Diſhes, there is very good in a Mannor of the Lord *Abergaveny*'s, near *Norwich*, in *Norfolk*, and Potters-Clay for *Pots*, and *Marl* in moſt *Counties*, with which they manure and much improve their Grounds; alſo earth for making *Brick* and *Tile* for Houſes, &c. of which there is plenty in moſt *Counties*, and commonly they burn to a *red Colour* : but there is a ſort of *Brick-Earth* in many parts of *Suffolk* and *Norfolk*, and in other Counties, which burn *white*, and are more laſting and durable than the *red*, and theſe, other *Countries* borrows from us; and we borrow from them the *Terra ſigillata*, *Terra Lemnia* and *Terra Armenia*, and many more of great uſe and Virtue:

but that which is common to us all, is *Sand*, and this is particularly used for those *Ovens* which are called *Sand-Ovens*, *Sculpture* II. and XXIV. for separating *Metals*: Now these have their several Names and Natures, as *Pit-Sand*, *drift-Sand*, *Sea-Sand*, *&c.* which may be experimented in *Chimical Operations*, *viz.* what kind of Sand is most proper for *Metals*, and what for *Mortar*, &c. But before I pass this Discourse, I cannot but speak of the *Sands* at *Icklingham* in *Suffolk* (yet spreading into *Norfolk*) having their rise from an *Hole* in that *Village*, therefore they are called *Icklingham*-Sands, or rather *Mowing's Sands*, but their Motion is different from all others, for these do not *move* but by a *Western Wind*, and then they go *East*, and lie still and compact in any *other Wind*, and yet it hath walk'd from thence above Eight Miles to *Brandon* and *Downham*, two Towns *East of it*, covering the ground at least a foot deep for more than a Mile in breadth; and whilst the ground is so covered it produceth not the least sprig of any green thing: Now *Brandon* and *Downham* are two Towns scituate on *Suffolk-side*, by the edge of the river *Ouse*, which runs from *Thetford* to *Lyn-Regis*: and the Inhabitants did make very high Banks to defend their *Meadows*, and to prevent the stopping up of the *River*, so that you might see good Meadow-ground on the *East-side* of the Bank, worth 20 s. an Acre; and on the *West-side*, *sandy* ground, the Inheritance not worth two pence an Acre to be sold. But the Inhabitants being not able to defend their River or Meadows any longer, left the *Sands* to act their pleasure: and then they fairly march'd over the *River*, and are gone about three miles into *Norfolk*, still keeping the same point of *motion*. Now, whether this proceeds from any extraordinary attraction of the Sun, or inclination of the Sands to the Sea-shoar, by way of sympathy, being about twenty miles *East-ward*, I shall leave it to further Consideration: and my reason of writing this was, that in *sand-Ovens* for *Metals* the different sorts might be tryed, some being of a very *fresh*, and some of a very *salt*, and others of a very dry Nature.

And

And I cannot but further obſerve,that the *Weſtern* parts do as much admire at the *Eaſtern* ſandy Grounds producing pregnant Crops, as we at their mountainous Crops, both having their *Fertility* from the artificial and laborious *Mixtures* of other *Earths*, with their *ſtones* and *ſands* : ſee Sculpture XLI. *Clay, Sand, &c.*

EGG, T. *Eye*. L. *Ovum*: *l*. 1. *p*. 20. this word hath as much difference in our Neighbouring Languages as any I meet with, and therefore I ſhall ſet them down; the *Greeks* call it *Ooen* : the *Saxons*, *Eghe* : the *Belgick*, *Eye* ; like the *Teut*, the *French*, *Oeuf* : the *Italian*, *Novo* : the *Spaniſh*, *Huevo*, &c.

In the *Egg* there are three parts, the *white*, the *yolk* and the *tredle* ; the *white* of an *Egg* is called in *L*. *Albumen*, T. *Eye-clar*, and by *Pliny*, *Ovi Albus Liquor*, and this is called *Eye clar*, from the bright ſpots in it, by whoſe delatation the *Coliquamentum*, which is made from it, is ſtiled (by that Learned Dr. *Harvy*,) the *Oculus* or *Eye* of the *Egg*, agreeable to the *German* word *Eye* ; the *Yolk* is called in *T*. *Totter*, L. *Vitellus*, from *Vita* ; the *Treddle* is called *Chalazæ*.

There is little uſe in Metallick matters of the *Yolk* or *Chalaze*, but our *Author* often mentions the uſe of the *white* of *Eggs*, as a chief Ingredient for *Lutings*.

But upon this occaſion of writing of *Eggs*, I am put in mind of a *Camelion*, which was beſtowed on me by Mr. *Faſſet* (an Eminent and Honeſt Chyrurgion) which was ſent him out of the *Eaſt Indies*, and with it the very *Stalk* and *Cluſter* of ſmall *Eggs*, as they were in the *Body*, and one *Egg* in its full proportion, as *white* as *Pullets Eggs*, and as big, conſidering the proportion: this *Egg* from the *Camelion* was a perfect round *ſhell*, whereas *Hens* are *Oval*, ſo as I find this difference, that the *Camelions Eggs* are *Oval* within, and are caſt out of the Mouth *round*, but *Hens* are round within and are caſt out of the Fundament *Oval* ; and the reaſon may be, that the *Camelions Eggs* comes out of its *Throat* (the extention of which is of one conſtant *Globular form* ;) and ſo *Snakes* and *Fiſh* (whoſe

(whofe *Eggs* are round) do fend them out of their Mouths,and then take them in again, as they perceive any *danger* to their *Spawn* or *Eggs*; but *Hens Eggs* come out of an *Orifice*, which opens by degrees, which makes the firft part of the *Egg narrow* (for the little end comes ever firft) and fo the paffage extending gently, the pliable *Egg* encreafeth in bignefs, and at the exclufion doth narrow it again, but not fo much as at the firft *egrefs*.

Now it is to be obferved, That when the *Egg* is unloofned from the *Knot* or *Clufter* of the little *round Eggs*, it foon receives extention into an *Oval form*,even whilft it remains in the *Body*, in complyance to its paffage through the *Fundament*; and whilft it is in the *Body*, it is prepared alfo with a *white Film* over the whole *Egg*, refembling, but is not a *fhell*, becaufe it muft endure *compreffure*,and being now *ripe* to be *expulfed*,then by a certain *fpirituous liquid Cementation*, or glutinous *varnifh* from its *Dung* (which paffeth out with it) and by the *ambient Air* (at its coming out) it is crufhed in an Inftant into a *folid fhell*, which will not endure *compreffion*: And this I mention the rather, becaufe I find that the Learned Dr. *Harvy* attributes the hardnefs of the *fhell* to the approaching *Air*, and not to the *Cementing Dung*, and doth not in the leaft Difcourfe of the caufes of *oval* and *round forms* of *Eggs*.

ELECTUARY, of which there are near an hundred mentioned in the *New London Difpenfatory*, whereof the chief are from *Metals* or *Minerals*.

ELIXAR is exalted Quinteffences, made by *infufion* and *Digeftion* of *Metals*,&c. whereof there are alfo 25 forts in the aforefaid *New London Difpenfatory*. the chief of them alfo are from *Metals*. See *Quinteffence*.

ELL, T. *Elen* & *Eblen*, L.*Ulna*,*Cubitus*,A.*Ell*. Now it is here to be noted, that the Englifh *Ell* is as long as two *German Ells*: and fo it is to be applyed proportionably to the making of *Furnaces*, &c. See *Finger*, *Hand*, *Meafure*.

ENAMEL, See *Amel*.

EQUILIBRIO, See *Weights.*

ESSENCES, (Doct. *Salmon.*) are the *Balsamick* parts of *Metals*, or of any other thing clearly separated from their gross parts, whereof 16 are numbred in his *London* Dispensatory, and the chief of those from *Metals* or *Minerals*. See *Quintessence* & *Elixir.*

ESUSTUM, T. or *Copper* calcined and then called *Calx Veneris.* See Products of *Metals.*

EVAPORATION, and to *evaporate*, T. *Dampffein*, or to take away the *Dampness* or *exhaling* of the humidous parts of *Metals*, by a gentle fire, or heat. (D. *Salmon*) L. *Evaporare*, or to take away *vapors.* See *Fumigation.*

EXPRESSION, T. *Ausz Trucken*, L. *Expremere*, i. e. a straining or drawing forth *Metals* or *Liquids* by pressing, and this done either with *Linnen* or *Leather.* See *Filtration*, and *Quick-silver*, the word is also applyed to the speaking fluently.

EXTERN. T. *Avez wendig*, L. *Externus*, or the outward part of *Metals*, or things.

EXTRACTION, T. *Ausz Zichen*, L. *Extractio* and *extrahere*, that is, the drawing the *Essence*, *life* or *vertue* out of any *Metal*, by a fit *Menstruum* or *Liquor* from *Oyl*, *Tartar*, *Calx viva*, *Vinegar*, &c. whereof above 60 are in Dr. *Salmon's New London Dispensatory*, and have peculiar names, *viz.* the Extraction from *Iron* is called *Crocus Martis*, and so of the rest.

FE FI

FECES, T. *Trusen*, L. *Feculæ*, or certain setlings which remain at the bottom of *melted Metals*, which may be reduced to a profitable *Pouder*; and we also call *fæces* from *facere*, or that which is made to flow or float on the *top*, or sink to the *bottom* of *metals*; and the word *Dross*, seems to come from *Ros*, or *thick dew*, which ariseth from *Metals*, and condensed bodies: also the word *flacks* T. is *Slacken*, L. *Scorias*, which signifieth also *Dregs*; and these are so called before the *Metal* it self is by *Præcipitation* cleared from them; and it may be observ'd, that *Argol* (the *Dregs* of *Wine*) which is *fæces* of another Nature, for it hath this Property, that as the *scum*, *dregs* or *fæces* of Metals fly to the top or bottom, this betakes it self to the sides of *Vessels*, as if it scorn'd to be called either *Scum* or *Dreg*.

FERMENTATION, T. *Saurmachen*, L. *Ferment* or to *leaven*, *raise* or *improve*; but as to *Metals*, it is used for *rarification*, *ripening* or *flowring* them by addition of *Ingredients*, as our *Bread* is *ripened* by *Leaven*, and *Beer* is *flowred* by *Yeast*, and in many parts of our *Author* it is used: See Dregs, Dross, Scoria's, Yest, *&c.*

FILE, T. *Feile*, L. *Lima*, A. *File* or *Rasp*, to file *metals* to a *Pouder*, and the *filings* are called *Limations*, but we use the word *File* in three other *senses*, *viz*. *File*, from *filum Thread*; a *File* of *Souldiers*; which may also come from *filum*, because they stand in a direct Line, like an extended piece of *Thread*.

FIL-

FILTRATION, alſo from *Filum* a *Thread*, becauſe *Cloths* woven of *Thread*, are uſed for ſtraining *Quick-ſilver*, &c. but that is more properly called *Expreſſion* (as before) for this *Filtration* is done two ways, either by *brown Paper*, or *Pendent Liſts* of *Cloth*, whereby the liquid Water may drop *guttatim*, from one Veſſel into another. *See* Expreſſion.]

FINGER, T. *Finger.* *See* Meaſure.

FINING, *Refining* and *Clarifying*, T. *Saeuberung* and *Reinguns*; L. *Purgare*, *Mundare*, and are only the making the *Metals* more perfect in their *Species* or *Kinds*, by often melting them from their *Droſs* or *Dregs*, *l.* 1. *p.* 18.

FIRE, T. *Fewr*, L. *Ignis*, is the chief *Operator* in the *Diſſolving* of *Metals*, ſtill ſhewing its power and activity on the *ſulphurous* part of *Metals*, and makes it fly away or ſubmit.

FISH-BONE, *T. Fiſck bein*, *L. Os piſcis.* See Bone-Aſhes.

FIST. *T. Tauſt. L. Pugnus.* *See* Meaſures.

FIXATION, to *Fixt*. *T. Heſten. L. Figere*, is the making of that which is *volatile* in *Metals* to be *Fixt* and endure the fire, and not fly away; and this is done by *ſublimation*, ſtill adding ſome fixt *Metals*; as *Lead-Glaſs*, *Lead*, &c to the *Volatile*.

FLAME, T. *Flam*, L. *Flamma*, or the Oyly part of Wood, or combuſtibles, impregnated by fire, for the more eaſy paſſing it ſelf into all the porous parts of *Metals*.

FLEAKY, *Flakes*, *flaky*, T. *Floken*, L. *Floccus*, *Fragmen* and *Strictura*, A. *Flaky*. See Shivery and Shivers.

FLEGM, T. *Rhoden*, L. *Flegma*, *Pituita*, or the *wateriſh*, *volatile* and *unfixt* part of *Metals*, and as in Man it is of a thicker ſubſtance than *ſpittle*, ſo in *Metals* it is of a thinner than the *Scoria's* or *Droſs*, and that which ariſeth from *Sulphur* or *Vitriol*, is commonly *acid*, *ſharp* and *ſalt*.

FLINTS, T. *Fewerſtein*, and ſometimes in the T. they are called *Horneſtein*, from the *colour* : L. *Silix*, there are ſuch ſtore of theſe in *Norfolk* that it makes a City in *Spain* ac-

accounted one of the *wonders* of the *World*, being encompassed with fire, that is *Flints*, to be no wonder: but the *Metalick Flints* are such as accompany the *Veins* of *Metal*, and from whence *Metal* is made; but whether the *Norfolk Flints*, though full of *Ignitous matter*, will afford the like, may be tryed, by such as do not value the charge of Experiments; and then the great *Labour* and *Expence* of digging in *Mines* might be saved. *l.* 1. *p.* 7. &c. *See* Stones.

FLOCKS (of Wooll) *L. Floccus*, the same with *Flakes*, *Flocks of Wooll*, *T. Ein Loken Wull* (*l.* 2. *c.* 20.) and *A.* called Locks of Wooll, by lasily using *l* for *f*, for it hath its name from a *number* of *Sheep* which bears the Wooll, which makes *Flocks* (being the remnants of the Wooll after *Combing* and *Dressing* it) for spinning; the like is made of the remnants of *Flax* after *Dressing*, called *Hards*, and both of these are much used for *Lutings*, and it may be a *Quære*, whether the *Flocks* of *Lemster Wooll*, which is the finest in all *England*, or *Norfolk* Wooll the worst, be the best for use? but I prefer *Leimster Flocks*, because its *Wooll* is called *Leimster Oar*, oftner than *Leimster Wooll*, because the feed of the *Sheep* consists of those *Hearbs* and *Plants* which have their Virtue from the metalick *Oars* under them; so as I know, that the *Sheep* of *Leimster*, being removed to places where there are not such *subterranean Oars*, their *Wooll* in one year will be adulterated by their *Feed*, the word *Flocks* is also *metaphorically* used for *Societys* of *Men*, and *Beasts* or *Birds*, &c. *l.* 1. *p.* 9. *&c.*

FLOWERS. *L. Flores*. *T. Blum*, from whence we have our Word *Blossom*; this word in natural Plants signifies such parts, as are extracted by the *Sun* into delicate *shapes* and *colours*, and as they are the last Works of *Nature* upon Plants, so that which *Chymists* calls, *Flos Auri* (or of any other *Metal*) is, as it were, the last *sublimation* or *extraction* by *fire* from any *Metal*; and as the *Flowers* of *Plants* have their vertues *superior* to all the other parts, as *leaves*, *stalks*, &c. so the *Flowers* of *Metals*, which some also call *Pouders*, are *superior* to the

Gold,

Gold, Silver, or any *Metal* in their ſubſtantial *Bulks,* or *multifarious* ways of *Extracts* or *Magiſteries.*

FLUS, *T. Fluez,* I retain the Word *Flus,* becauſe it comes from the *L. fluere to flow,* as that which is *fluid* or *flowable,* and and ſometimes (as it is a Compoſition of the *Glaſs* of *Lead*) it is called *Lead-Glaſs,* which being put into diſſolvible *metal,* it gives expedition to their Diſſolutions (*l.* 1. *c.* 8. *c.* 26. ſo *l.* 2. *c.* 5. &c.) and from hence may come the Word *flushing* or *flowing* of the *Blood* to the *Face,* from other parts, &c.

FORCEPS. *T. Tangs. L. Forceps. A. Tongs.* See Utenſils.

FORGE. *T. Einſchuide. L. Fabrica.* See Utenſils.

FORREIGN. See Outlandiſh.

FORMS *Chimical.* *See* Salt.

FRESH, T. *Friſch,* L. *Recens.* *See* Oars.

FUMIGATION, from L. *Fumus,* A. *Smoak,* T. *Rauch,* but as to *Metals* it is uſed when they ſend up *ſharp* and *ſtifling Spirits:* ſee *Evaporation,* but note that *Fumigation* is applyed to *dry bodies;* *Evaporation* to *liquid,* to ſhew the difference between *Fumes* and *Smoaks.*

FUNNEL. *See* Utenſils.

FURNACE. *See* Utenſils *and* Ovens.

FUSION, *T. Geiſſig;* the *Word* is oft uſed by our *Author,* and by *Metalliſts,* but more by *Diſtillers;* ſometimes ſignifying putting in; from *infundere* and *fundere,* and ſometimes in *metals* called *fuſile* or *fuſible,* being ſo meltable as it may be poured in or out.

GA GA

GAMAHEZ, is an *Arabick Word*, ſignifying the *Figures* of things (as of *Birds*, *Beaſts*, *Snakes*, *Trees*, &c.) *naturally* repreſented in or upon *Stones*, which uſually attend *Mines*, as other tranſparent *precious* STONES do, as I have ſhewn under the words COLOURS and YELLOW; for I intend not here to ſpeak of *Taliſmanical Figures* from *Conſtellations*, for which I refer you to *Gafferel*, *G. Agricola*, &c. But firſt of the *outward Figures* of *Gamahezies*, of which ſort I have ſeen many taken up about *Aderly* and *Pomfret* in *York-ſhire*, and in other parts of *England*, which do perfectly repreſent *Snakes*, as they uſually lay *roll'd* up in the Earth, when *alive*, ſo as theſe ſeem to be *Snakes* petrefied, only their Heads are wanting in all, and they are ſeldom above two or three Inches Diameter, and of a blackiſh colour, yet I have heard of, but not ſeen, ſome inclining to a *Goldiſh Colour*: But it was my chance in the Year 1668. to find (on the ſide of a Stone-Cawſy, between *Burport* and *Axminſter* in *Dorſetſhire*) one of the largeſt *Snake*-ſtones that ever I heard or read of, being above ſix Inches Diameter, and of a *Free-ſtone* colour, and one might judge that there had been an *Head* on it but broken off, and as a *Rarity* I beſtowed it on Dr. *Warner* one of his Majeſties Phyſicians, which was very acceptable to him.

Now as to the *inward Gamahez*, I had ſome years ſince a *whitiſh* Flint, inclining to a *light Blew*, which being caſually broke in two, upon the inſide of the two broken parts, there

were the perfect Figures of a *Tree*, with black *Lines* and dilicate ſhadows, ſuch as I have ſeen in *Paintings*, repreſenting *Trees* in the midſt of *Snow*, and ſo ſeem'd the *black* Figures on the *white* Stone: I then thought my ſelf well skill'd in that *Art*, ſo I could not but give my Verdict on *Natures* ſide, beyond any *Arboreal* Figure that ever I ſaw done by *Art*.

GALLON, *T. Kandel, L. Brocus*, and from *T. Kandel*, the word *Can* or *Veſſel* (to drink with) is derived; the proportion of which differs in *England*, as it doth in *Germany*, being in ſome parts four, in others two quarts, which is a *Gallon*.

GARDIAN, *T. Gaerdigein, L. Gardianus.* *See* Warden.

GUILDERS, a *German Coyn* (ſee Money) alſo ſuch as uſe to lay *Leaf Gold* upon Metal, or otherwiſe, to make it appear like *Gold*, are called *Guilders, T. Guilder, L. Aurare*: ſee Mony.

GLASS, *T. Gleizen, L. Vitrum*, is by fire produced from all Metals, but that which is of moſt *uſe* for helping to diſſolve Metals, is produced from the *Droſs* of *Lead* or *Tin*, and ſo called *Speize Glaſs*, and *Tin Glaſs* (*l.* 1. *c.* 8. and *l.* 2. *c.* 23. *See* Lead.)

There is alſo that which is called *Glaſs-Gall, Glaſs-Cup* or *Hematithe*, a *Stone* of which *Glaſs* is made, and uſed alſo for Metals (*l.* 2. *c.* 3. and *l.* 3. *c.* 5.)

GLASS-CUP, T. *Glaſs-Kup* and *Blutſtein, L. Homathites, A. Blood-ſtone* (*l.* 1. *c.* 34. 59.)

GLASS-GALL (*l.* 3. *c.* 5. 52. See Glaſs.

GOE, or to *goe*, the word is commonly uſed as a motion to the diſſolving of *Oar* or *Metal*, and ſignifies much of the ſame with *driving* and *flowing*, being only *degrees* and *terms* of *Art* towards *diſſolution*.

GLIMMER, or *Glumering*, T. *Glantz*, L. *Splendere*, A. *ſhining Oar*, which the *Latines* call *Rutilatio* not properly ſo appliable to *bright Oar*, but *Reſplendeſcentia* may do well enough. (*lib.* 1. *cap.* 2. 5. 11. & *lib.* 2. & *lib.* 3. 7. 4.) *See* Oars:

and ſometimes, it is taken for *Tallow*, *lib.* 2. *cap.* 28.

GOLD, *lib.* 2. *&c.* It was writ ſo by the old *Saxons*, and *Britains*, and ſtill ſo by the *Danes*, but the *T.* now *Goldſt* and *Belgick Gout*, and if we obſerve what little difference there is between *Gott*, *Gut* and *Gud*, uſed in theſe two Languages for *God*; and *Gout* and *Goldst* for *Gold*: We may well think thoſe *Ancients* did make this *Metal* their GOD; and that we may not altogether blame them, we may well bring-in the *Spaniſh* and *Italians*, who call this *Metal*, ORO, ſignifying to *pray*, as if it were a *Metal*, to which their Fore-Fathers did pay their *Devotions* and *Prayers*: and all of us ſeem at this day to be guilty of this *Metallick Idolatry*: but to prevent that Imputation, the *Latines* call it *Aurum*, and *We Gold*, being of a different *Dialect*, from almoſt all the preſent *European Languages*, except the old *saxons*, as I ſaid, and *Danes*.

Now, as *Quickſilver* is called *Mater*, ſo this is called *Pater Metallorum*, and therefore there may be ſome Diſpenſation for a *filial Love* to the *nobler Part* of our *Mother Earth*, eſpecially if it be without *idolatrous* and *covetous Applications*. We have little *natural Gold* in *England* from any of our *Mines*, yet we are not altogether without it, for I am aſſured from a *Corniſh* Gentleman, that hath a conſiderable Intereſt in the *Stanneries* of *Cornwall*, That in digging for *Tin*, they often find little *Grains* of *Gold*, not in the *Tin-metal*, but in the outward ſandy circumjacent parts of their *mines*: and that the biggeſt he ever ſaw, was not above the bigneſs of a ſmall *Pea*, nor need we much to ſearch for it, or labour artificially to make it: for what we have from other parts in *Africa*, *Aſia*, and *America* do ſufficiently ſupply us, eſpecially our late *Trade* with *Guinea* in *Africa*, from whence 'tis brought to us in little *Grits* or *Seeds*; yet I was told by an eminent *Goldſmith*, That he had often bought pieces of above an ounce in Weight, and that was ſo good, that though it had not an high Colour, yet the Colour was recompenced by the

the little loſs in melting : Whereas the *Seeds* of other *Gold* are much adulterated with the *filings* of *Iron*, which they draw off by the *Loadſtone* : but when they bring their *Artificial Gold*, made into *Duccates*, they are firſt to uſe their *skill* in ſeparating a conſiderable quantity of *Silver* from the *Gold*, which is commonly made by *Art*, to contract the *Gold*, whereby it will indure the *touch* like *Gold*: but their *Sciſſers* ſoon decide the Controverſy, and cheat: ſo as *Art* diſcovers the *Artificial Gold* from other mixt Metals. Our *Author* ſaith, *lib*, 2. *c*. 1. That the *ſeed* of *Gold* came out of *India* by *Nilus*, wherein he is miſtaken (as other former *Antients* were) in taking *Gebon*, in *India*, to be in *Aſia*; of which Miſtake, Sir *Walter Rawligh* hath convincingly ſhew'd their *Error* (*H.M.l.*1. *c*.6.) Yet very probably *Nilus* may afford Variety of *Gold*, in reſpect it hath its *Heads*, from the two great *Lakes* of *Zambre* and *Zailar* (and not *Zambre* alone, as Dr. *Heylen* would have it) in the lower *Æthiopia*, and paſſeth the upper *Æthiopia*, or *Habaſines Empire*) which is full of *Gold*, and then running above 2000 miles, and ſo may well bring it into *Ægypt*, and from thence caſt it into the *Mediterranean Sea*, and by that Sea toſt into *Aſia* and *Europe* : But, as I ſaid, We have a ſhorter and better way for it to *Guinea*, in *Africa*, from the river *Nigro*, and the Coaſts of it, and that we may the better credit a greater *Efflux* of *ſeeded Gold* from thence, than from any other in *Africa*, 'tis found by late *Geographers*, that this *River* doth rake the very Bowels of the Earth for it, for it ſeems (as they tell us) that it hath its riſe from a great *Lake*, called the *Black Lake*, within two *Degrees* or 120 Miles of the *Equinoctial* (and within four *degrees Eaſtward* of the *River Nile*) and ſo it runs *Northward* about 600 Miles) whereof under ground about 60 miles) and then riſeth again and falls into the *Lake Borneo*, from whence it bends it courſe directly *Weſtward* (differing from the courſe of *Nile*, which runs directly *North*) and ſo after it hath run above and under ground more than 3000 miles (through many Kingdoms and Countries, rich in *Gold*) it un-

unlades its *Treasure* into *Guinea*, by many leſſer ſtreams, where the Natives are always dealing for *Gold*, and it ſelf at laſt in the *Atlantick* Sea, over againſt the *Iſlands* called *Heſperides*; ſo as we never croſs the *Equinoctial* to go thither; which is leſs trouble than unto the fartheſt part of the *Mediterranean* Sea, where *Nile* vents it ſelf: or to the Mouth of the two Eminent *Rivers* of *Ganges* or *Indies* in the *Eaſt*-part of *Aſia* (andtherefore called the *Eaſt Indies*:) Now where the land of *Havilah* which *Piſon* encompaſſeth (miſtaken for *Ganges*) wherein there was *Gold*, and the *Gold* was called *good*; as alſo where *Paradiſe* was, or is, whether beyond our *known World*, or the *Middle Region* of the *Air*, or elevated near the *Moon*, or as far *South* as the *Line*, or as far *North* as that *Line*; or whether near *Havilah* in *Africa*, or *Havilah* in *Aſia*; or whether a place called *Eden* or *Paradiſe* was peculiarly created for the *Reception* of *Adam* after his *Creation*; and *Chriſt Jeſus* after his *Reſurrection*; I ſhall leave to Sir *Walter Rawleigh*, and others to determine, but we are aſſured from the ſacred *Story*, that there was *Gold* near that Place, and that then (in the Innocency of times) the *Gold* was good; which muſt be known by *Aſſaying*, and doubtleſs that Knowledg was communicated to *Adam*, yet we hear no more of *Gold* in that *Holy Writ* till 2800,after *Adam* (though it was accounted the Golden Age) and then, (*Gen.* 24. 22.) *Rebeccah* was preſented with *Gold-Earings*, and *ſhekles* of *Gold*, ſo it ſeems they had the *Art* of *Melting* and *caſting* *Gold* into *Aſſayings* and *Forms*, as may be collected from the ſeveral *Distinctions* in the *Sacred Hiſtory*, concerning *Beaten Gold*, *pure fined* and *refined Gold*, and *crown Gold*; And we are aſſured that in *Moſes*'s time, they had the knowledg of all Metals, as may be read in *Numb.* 31. 21. where *Moſes* taught the Soldiers how the Spoils of their *Heathen Enemies* were to be purified, commanding (as from GOD) That all their *Gold*, *Silver*, *Braſs*, *Copper*, *Tin* and *Lead*, and every thing that endureth the *fire*, (in the *furnace*, according to the

Syriack) should be purified by *fire*, and then to be accounted *clean*: yet, it is also said in that Text, That it shall be *purified* by the *Water* of *Separation*, by which *water* certainly is meant *Quick silver*, because this doth *purify*, *cleanse* and *devour Metals*; and so Dr. *Salmon* calls it a *Volatile Juyce* or *Liquor*; for nothing but *Fire* or that *Quick silver* or *Aqua fortis* can seperate those *Metals*.

Now of that *Text*, the *Commentators* gives but little account, passing it in general, only as a *Water of Purification*; whereas there were two sorts of *Water* of *Purification*: viz. that which is mentioned for *purifying* Metals, and this other for *purifying Men* and *Women*, which in *Numb.* 29. unto *verse* 11. is plainly set down, how, in what manner, and with what *Ingredients* it was composed: *viz.* that a young *Red Heifer*, without *spot* and without *blemish*, and which was never put into a *Yoak*, was to be brought to the *Priest*, and one was to slay her before his Face, and the *Priest* was to take some of her Blood with his *finger*, and *sprinkle* it *seven* times before the *Tabernacle* of the *Congregation*; and then the *Heifer* with her *Skin*, *Flesh*, *Blood* and her *dung*, was to be burnt in his sight, and whilst it was burning, he was to cast into the midst of its fire, *Cedar-Wood*, *Hysop* and *Scarlet*, and after that, both the *Priest* and he that burnt the *Heifer*, washt their Cloaths with *Water*, and bathed their *flesh* also in *Water*, and yet they remained *unclean* until the *Even*: (by which time, it may be supposed, that all was dry'd) in the mean time, *one* that was *clean* was to gather up the *Ashes* of the *Heifer*, and lay them up clean without the *Camp*, and he also, for this *act*, was to be accounted *unclean* until the *Even*; and these *Ashes* were kept (as *Lees*) to put into *Water*, which was call'd the *Water* of *separation* for the *Congregation* of the *Children* of *Israel*, as also for *Strangers* sojourning with them to be *sprinkled* with, and thereupon also called the *Water* of *Purification* for *Sin*, *ver.* 9. so as we see clearly this *Water* of *Purification* of *Men*, was a distinct *Water* from the *water* of *Purification* and *Separation* of *Metals*; and the Ingredients of one

one is communicated to us, but the *Holy Spirit* thought fit to conceal the other from us; However, this *Science* of *Purifying Metals*, did dayly improve, which *Historians* and *Phylosophers* shews us, before *David* and *Solomons* time, which two Kings are plentiful in their expressions of *fining* and *refining Gold* and *Silver*; and these Arts *David* most Divinely applys to our *Souls*, which by often refining (like Metals) are brought to *Perfection*: and this *Science* did so encrease in *Nehemiah's* time (*Chap.* 3.) that it grew to a *Trade*, and the *Professors* thereof called *Gold-smiths*, and so Gold and the Trade for it continues still in the World.

But I perceive since *Christ* said to the *Thief*, That he should be with him that day in *Paradise*, there hath been more search after the place of *Paradise*, than before; not for the Pleasures in that place, but for its *Neighbourhood* to *Havilah*, wherein 'tis said, There was *Gold* which was *good:* And therefore in this Discourse, having traced the four great Rivers of three parts of the *World* for it, I may venture the fourth, *viz. America*, and ask whether *Pison* be not the *Ocean*, or one of the four streams or Sea's which encompass *Havilah*, or a Countrey abounding with good Gold, for seeing it is not agreed where *Paradise* is, and what were the *four Streams*: I hope, I may not give Offence in rendring this great *Iland* or *Continent* of *America*, surrounded with a *Pisonick Ocean*, to be the same, or some such like place as *Havilah*; and well may we trade thither for *gold*, where *Religion* shews us the way; for Divine *Herbert*, in his *Church Militant*, tells us, That

Religion stands on Tip-toes (and from our Land)
Ready to pass to the American *Strand.*

Now if *Religion* goes thither, we may safely follow it, so as it be in pursuit of *Paradice* or *Havilah*; and seeing it is not agreed that they are in *Asia*, *Africa* or *Europe*, though *Lombardy* in *Europe* is called *The Garden of the WORLD*, we may try whether there be any *Havilah*, or something *equiva-*

lent

lent to it in *America*, and leave *Paradice* to the prognosticated *Religion* to find it out.

Now if we may Credit the Writers upon that great Continent or Island (*Nicols*) it extends from the *Artick* to the *Antartick Circle*, and hath its breadth in some parts proportionable; and in this great spot of *Earth*, there is a greater plenty of *Gold* and other *Metals*, than we can find from the other *Havilahs*; but I shall conclude here, because I shall speak more on this Subject in the manner and way of getting and washing the *Seeds* of *Gold*, and other Discourses of *Gold*. See the VVords Metals, Mines, VVashings.

GRADUATION, T. *Gradierung*, L. *Graduatio*, from *Gradus*, A. *Degrees*; but in its *Metallick sense*, it is applyed to the *melioration* of *Metals*, by certain *degrees*, either to that *colour* or *virtue* which is most *proper* and *natural* to them: (*l.* 2. *c.* 9. & *c.* 45. *&c.*) and the Word is also applyed to *Graduates* in the *Universities*, who by degrees are sensibly *Refined* by the *Liberal Arts* and *Sciences*.

GRAINES, T. *Koernleine*, L. *Granum*, and both in the notion of Weights, have reference to a grain of Corn, from which Weights have their original. See VVeights.

GRANULATION, T. *Kuernen*, from whence I suppose we have our word *Cornel* or *grain* of *Wheat*, *Barly*, &c. and it comes from the former Latine Word *granum*: in the Metallick sence, it is considered as a certain proportion of *melted Metals*, made by *Art*, into the smallness of such *grains*, so as they may be the better weighed, and is a peculiar *Art* in performing them (*l.* 1. *c.* 19. &c.) See VVeights.

GREY, T. *Graw*, L. *Glaucus*, *Cinereus*, *&c.* See Colours.

GREEN, T. *Greisen*, L. *Viridis*, but it hath its particular *names*, according to its *Resemblances*, *viz*. *grass Green*, *Herbeus*, *Leek-green*, *Prosinus*, and so of the rest. See Colours.

GROUND; this Word hath many senses in our *English*, *viz*. *Ground* or *Earth*, *Foundation* or *Principle*, or *Reason*; but

here it doth signify such *Metals* as one doth *grind small*. *T.Malen* and *Gerienen*, L. *Molare*, that is, being ground, it is a Foundation to other proceedings.

HA H HA

HAND. *See* Measures.
HEARTHS. *See* Ovens.
HELLER. *See* VVeights.

HELM, *Helmet. T. Helm, L. Tegumentum*, made of *Clay* or *Iron*, used in the *Metallick Art*, for covering of *Ovens*, &c. as in *Sculpture* XVII. *&c.* the Word is also used for an *Head-Piece* in time of War, and for the chief *Rudder* that guids a *Ship*, all signifying something of a *Defensative* or *Preservative Nature*.

HEMATHITE, which is no other than the *Blood-stone*, of a dark-red colour, *L. Hematites, T. Blutstein. Pliny* saith, It is of Kin to a *Load-stone*, of which there are ten sorts, but that which is called *Hematites Fossilis* (digg'd out of *Iron Mines*) is of a Purple *Colour*, which we do not find in *England*, and but some few of the other. *See* Glass-Cup.

HERMETICK-SEAL, that is, to joyn the Mouth of a *Glass*, first heat in the fir e,and then nipt together by *Pincers*; so called from *Hermes* the first Inventor. *Pliny*. *See* Cement.

HORNY. *See* Horny Oars.

INCH.

IN. I. IR

INCH. See Measures.

INCINERATION and *Reverberation*, are two sorts of Methods in *Calcining Metals.* See Calcing and Ashes.

INCORPORATE or *Incorporation* ; that is, when *Metals* are mixt, they are called *Incorporated*, or their Bodies joyned together : and from hence *Bodies Politick*, or a number of Men joyned in a *Fraternity*, are called *Incorporations*, because they consist of all sorts of *Tempers* and *Metals. l.* 2. *c.* 1. *s.* 2.

INFUNDING, *Infusing* and *Infusion* (*lib.* 1.) that is, a pouring or putting : in but the *Infusion* of *Metals* and of *Plants* have two ways of proceedures. See Fusions.

INGOT, called by that name in the *Teutonick* and *English*, and is a little long *Vessel* wherein *Gold* is *cast*, which *Vessel* is called an *Ingot*, and the piece of *Gold* taken out of it hath the same Name. *l.* 2. *c.* 47. and *Sculp.* XXVIII. *Fig.* 5.

INSPERG is oft used in *Erkern*, from *Inspergo*, when one *Metal* hath certain *parcels* or *sprinklings* of other *Metals*, whereby their goodness is seen before *proving. l.* 4. *c.* 1.

INSPISSATION, is the method of *Fixation* of *Metals*.

INSTRICK, is a Term of Art, used to signify the first *work* in *separation* of *Metals*, *l.* 3. *c.* 22.

IRON and *Steel* : *see* Metal : *T. Eysen*, *Iron-man*, *L. Ferrum* and *Chalybs* ; *l.* 2. *c.* 20. *s.* 2. See Oars,

JUG, *T. Krug*, *Heb- Chug*, A. *Jug* or *Pot* : so it seems we do retain the Word, which is of little difference from the *Hebrew.*

KE KE

KETTLE, *T. Keſſel, L. Cacubus.* See Utenſils.

KELL or *Kiln*, or *Kill* for metallick Matters, *T. Kalck-Ofen, L. Fornax* and *Calcaria, A. Kill*, they are allſo uſed by that name, for drying *Malt*, &c. *See* Furnaces *and* Ovens.

KEINSTOCKS, I retain the word as very proper, and is fully *explained. l.* 3. *c.* 22. *See* Thornels.

LA LA

LADDER. *See* Utenſils.

LEACH (*l.* 3. *c.* 26.) this word I retain ſignifying *hard work* (often mentioned by *Erkern*) and the *Etimology* may be, becauſe ſuch *hard Work*, do occaſion *Le Ach*, on the *Ach* in the *Joynts* of the *Operators.*

LAMIUS. *T. Bleck. L. Lamina*, A. the *Plates* of *Metals. l.* 4. *c.* 4.

LAPIS LAZULI, *l.* 1. of which *Blew Vitriol* is made.

LA-

LAPIS CALAMINARIS, L. *Cadmia*: ſee *Cadmia, Calaminaris* and *Stones*.

LAPIS TUTIJ, a *Compound* made of *Calaminaris*, good for ſore Eyes. *See* Calaminaris *and* Stones.

LATTEN, *T. Latton, Auri Chalcum* and *Orichalcum*, alſo *Coronarius*, and is a Compound of *Copper* and *Lapis Calaminaris*, and ſo caſt into Forms and not wrought with *Hammers*, in reſpect of its *friableneſs* or *brittleneſs*, that which is alſo made of thin *Plates* of *Iron* and ſo *Tin'd* over, is vulgarly called *Latton*. *See* Plates, Iron, Tin.

LEAD, *T. Bley*, *L. Plumbus*; it is called alſo (*Howel*) *Aurum Philoſophorum*, becauſe it doth as it were govern *Gold* and other *Metals* in their *Precipitations*, and from thence wee uſe this word to *lead* or *conduct*, becauſe this *Metal* doth as it were, *lead* and *conduct* us to the knowledge of all other *Metals* (*l.* 4.) and ſeveral other parts: ſee *Metals*; and certainly no *Metal* hath more excellent effects in *Chyrurgery*, than the *Artificial Leads* made of it, under the names of *white* and *red Lead*, and therefore it is put under the higheſt *Planet Saturn*, ſlow in *motion* and ſure in *operation*, and of this virtual *metal* we have as good and as great quantities in *England* and *Wales* proportionably, as in any parts of *Europe*; beſides the great quantity of *Silver* contained in it: But before I cloſe this Diſcourſe (becauſe it was omitted in the word *Ceruſe*) I muſt inform you, that for this *common Lead* (which is a *natural Metal*, and plentiful in all our *Mine-Countries*) there are *Mills* erected (ſuch as the *Society* for the *Mines Royal* have in *Wales*) where they make *white Lead* (which is only a product of that *Metal*, *Lead*, corrupted with *Vinegar* or *Urine*, and afterwards being ground in the Mills, and formed into a *white colour*, is called *white Lead*, and after that *Refined*, and then hath the name of *Ceruſe*, which yields the beſt and moſt perfect *white*, and at theſe Mills there is made alſo *red Lead*, of the common *Metal Lead*, and is brought to that *colour*, only by the *Art* of uſing Fire to it; and both being thus made, as

well the *red* as the *white*, are of excellent uſe, not only for *Painters*, &c. but to all *Chirurgeons* (as I have ſaid:) There is alſo a *mineral Lead*, which we call *Black Lead*, ſomething like *Antimony*, but not ſo ſhining or ſollid, of which ſort I know but of one *Mine* in *England*, and this yields plenty; both for our ſelves and other Nations, and this *Mine* is in *Cumberland*, which they open but once in ſeven years (I ſuppoſe the reaſon is, leaſt they ſhould dig more then they can vend) this alſo is uſed by *Painters* and *Chyrurgeons*, *&c.* with good ſucceſs, eſpecially being mixt with the products of *Metals*: and of late, it is curiouſly formed into caſes of *Deal* or *Cedar*, and ſo ſold as dry *Pencils*, ſomething more uſeful than *Pen* and *Ink*.

There is alſo a white *Mineral* in *England*, called *white Chalk*, tending to a tranſparency, but of a *Leadiſh* quality, and therefore I place it here, rather than under Earths or Stones.

LEAD-GLASS. *See* Fluſs.

LEATHER. *See* Utenſils.

LIMBECK, T. *Alimbick*, L. *Alimbicus*, *quia extrahendo materiam lambit* (*Minſhaw*) and alſo called *ſublimatorium*, *quia materiam evehat in ſublime*, and he ſaith, it is an *Arabian* word; but in ſhort, it is a kind of an *Oven* or *Furnace* made of *Metals*, vulgarly called a *Still*, and uſed more for diſtilliug Waters than Metals, and is ſometimes mentioned by *Erekern*, but chiefly as an *Helmet* to the *Athanor* or *great Furnace* (*l.* 2. *c.* 32. *ſ.* 7.) Now of theſe *Stills*, I deny not but thoſe which we commonly uſe, are very fit for their purpoſes; but I have contrived one (whereof I have made often *Tryals*) which perform the like, with much leſs *fire*, and leſs *trouble*, becauſe the fire need not to be tended but once in 10 or 12 hours, and the Waters (of ſeveral ſorts) which I have Diſtilled in it, are every way as effectual, but the *manner* and *way* of Diſtilling therein, doth every day improve in my *Experiments*, and when it is fitted to effect all the intents and purpoſes of the *common Stills* (with ſome additions, which they cannot perform) I ſhall divulge

vulge the *Invention*, without *Patent*, or any expected *Reward*, but thanks. *See* Quick-silver.

LIMETS. *See* Files.

LIME-CALX, I have writ something of this, under the word *Calcine*; but now I shall speak of *Lime*, or the *Calx* of *Lime-stone* or *Chalk-stone*, which *Calx* is used both in *Cementings*, *Lutings*, and in melting of *Metals*, with other *Ingredients*, but the great use of this *Lime*, is to make *Mortar* for *Buildings*, and therefore I shall refer it to the word *Mortar*: only observe this, That when *Lime-stone* or *Chalk*, whilst it is immediately from the *Pit* or *Quarry* (because it is properly a *Stone*, though of a soft nature) is called *unslack't* or *unburnt Lime*, but when it is burnt, called *slack't*, and so all Metals *unburnt* or *burnt* may be also called, *unslack't* or *slack't* and the pieces *slackes*, which word is often used.

LINNEN. *See* Utensils.

LIQUATION, L. *Liquatio*, from *Aqua* & *liquidus*: *A liquor* or *moisture*; and *liquation* is a term in this Art of *Chimistry* for one of the Methods in dissolving *Metals*, and the word *liquifaction* of the like sense, and from the same *Radix* is also applyed to *Metals* when they are *melted* by the heat of *fire*, or *Sun*: *See* Conglutination.

LITTARGE, T. *Blegg Leidt* or *Glet*, L. *Lithargicus*, or the *stone* of *Gold* or *silver*, from the Greek *Lethos*; and sometimes called the *spume* or *froth* of *Gold* and *Silver*, but generally the *Excrements*, *Scoria's* or *Dross* of *Gold* or *Silver* caused by *Lead*, and if it be *Gold-Litarge*, it looks of a *Yellow Colour*, and tho it be dross; yet the Metallists give it this distinct name, because it hath more excellent *Virtues* than any other *Excrement*, *Recrement* or other *Dross*, and that it may be cleared from other words of almost the same sound; I think it fit to distinguish them here: This word is written *Littarge*, and by some *Lithargy*, and that which signifies the publick Office of *Devotions*, LITTURGY; and the *sleepy* Disease, LETHARGY (with an E:) and I wish that the plenty of our

our *Littarge* or *Lithargy* may raiſe up our *Litturgical Devotions* to be delivered in all times of our *Wealth*, and from the *Lethargical* or *ſleepy hours* of *Death*,as well by our*Devotions* as by the excellent *ſpirits*, &c. made of our *Littarge* peculiar to that *Apoplectick Diſtemper*. (See *thoſe words.*)

LIXIVIUM, See *Menſtruum*, *Lee* or *Lees*.

LYE,called alſo *Ligh* or *Lees*,to diſtinguiſh from a *lye*, or *to lye*, or to ſpeak *untruth*, or to *lye* or *lay* down to *reſt*.) T. *Langen*, L *Lixivium*,from *Lix* ſignifying *Aſhes*, or as *Minſhaw* calls it, *Humor Cineri miſtus*, of which ſee more in *Buck* and *Menſtruum*. And here I may obſerve that as in Latine, *Lix* ſignifies*Aſhes* ſo *lixa* is *Water*; and thoſe two mixt, makes the *lees*, with which women *waſh* and *buck* their *cloths* for ſo *lixa* alſo ſignifies.

LOAD-STONE or *Magnet* (lib.4. cap.21 and 22.ſ. 4.) T. *Magnet-ſteine*; but when it hath relation to *Navigation*, 'tis call'd *Segel-ſteine*, or *ſail-ſtone*; but the Latines *Magnes* and *Magnificus*: and A. from the *Saxon*, *Load or Leading ſtone*, or *lapis cujus ductu Nautæ inſtituant curſum*; and *Erckern* for this and many other qualities calls it a Jewel, and 'tis pretty to ſee how the Latines quibble about this word *Magnes*,for they call a great Man *Magnas* (on the account of Honour ;) and *Magnus* great, on the account of bulk, *&c.* and this ſtone *Magnes*, being of ſo great Virtue, that it is *ſcarce comprehenſible*, and 'tis probable, that the other two *words* do borrow their *titles* from it.

Pliny tells us, (*lib.* 7.) That this word *Magnes* was given from*Magnes* the Name of a Shepherd who was the firſt finder of it, and makes *five kinds* of it (*lib.*36. *cap.* 16.) *Cardanus* but three kinds, who obſerves, That *Ariſtotle* was altogether ignorant of the *maratine* uſe of it, and that *Galen* and *Al. Aphrodoſius* (two great Inquirers into the ſecrets of Nature) have not ſo much as once mentioned the wonderful Nature of this *Stone:* but now *Authors* do abound in their diſcourſes upon it, and make all things eaſy and plain in their *Naratives* of its *Virtues*

tues and Operations: only when their Diſcourſes are apply-ed to its *Variation* by the *Needle* (touch'd with it for the uſe of *Navigation*) there they diſagree very much in their Opinions; and amongſt the reſt', *Boetius* tells us, (*cap. de Magnete*) that there are two *magnetick* Mountains; and that thoſe *magnets* which are digg'd neareſt to the *Artick Pole*, have moſt of the *Artick Virtue*; and ſuch as are digg'd neareſt to the *Antartick*, have moſt of the *Virtue* of the *Antartick*; which is the cauſe of their *Variations*, and many other pretty and plauſible notions are writ of them, but I ſhall only mention ſome of my own Obſervations.

1. That this *Stone* is found in moſt *Iron-mines* in *England*, but are not ſo effectual in their *attractive power* as thoſe which we have from *foreign Parts*, and therefore ours need to be nouriſhed with *filings* of *Iron*) for ſtones have a *vegitable life* to be preſerv'd) and to be kept from the *Juyce* of *Onyons* and *Garlick*, and moiſt places, which do unglutinate, and ſo deſtroyes or ſubdues their Virtues: and therefore thoſe *Lapidiſts* whoſe Art it is to fit *Loadſtones* for *Navigation* (or other uſes) will not ſuffer thoſe *Plants* to be near them: and I have often try'd, That when I have touched my knife with a Loadſtone, and thereby impowred it to take up *Needles* or ſmall Weights (and ſo it holds its Virtue many dayes) but the *Knife* once touch'd with an *Onion* doth utterly looſe the *Virtue* which it borrowed; I confeſs I never tryed *Onions* or other *acid things* to the *Poles* of my *Loadſtone*, becauſe I choſe rather to believe than hurt the *Stone*: eſpecially a *Lapidiſt* of my Acquaintance affirming the Truth of it, who was ſo great an *Artiſt* that he told me, That with a *Magnet* of the bigneſs of my head, he could drive the *Soul* of it, into as little a compaſs thereof as a *Nutmeg*, but before I could ſee the *effects* of his *Art*, I was diverted with other Occaſions, and could never find him after. Yet it was my good fortune to be acquainted with a worthy Gentleman *Francis Smith* Eſq; (of *Ruſhoke* in *Worceſter-ſhire*, ſince deceaſed) who was Maſter of

much found *learning* and very ingenuous in his Discourses, when he thought fit to expatiate himself; or otherwise reserv'd: and we happened upon the Discourse which I had with the *Lapidist* upon which he produced a *Loadstone*, fixt with its irons for the *North* and *South points*, which I had the freedom to weigh in my *Gold Scales*, and the *Iron pieces* and *points* and *Gold* (for *Ornament* which embraced it) weighed just *eleven grains*, and it attracted a *piece of Iron* of an ounce weight. Now, there being according to the *Venetian* account 6912 *Grains* to a *pound*, every ounce is 576 *grains*, which is 52 times 11 *grains* so that it took up an *Iron* of above 52 grains more than its own weight (considering its embracers) and by my description of the *Lapidist*, he believed, it was bought of the same person and looking upon it as a very great Rarity, I took upon me the Confidence to tell him, That it was pity so great a Jewel should lye concealed, and added, that I believ'd it would be a very acceptable Present to his Majesty: He approved of my Proposal, and accordingly did present it, and it was so accepted, and got a good *Office* soon after, I cannot say for that, (though it deserved it) but for his own Deserts, and I hope it is still preserv'd amongst his *Majesties* Rarities.

Another piece of Curiosity I saw in the Hands of Sir *William Persal* (since Deceased also) *viz.* a *Terrella* or *Load-stone*, of little more than 6 *Inches Diameter*, turned into a *Globular Form*, and all the *Imaginary Lines* of our *Terrestrial Globe*, exactly drawn upon it: *viz.* the *Artick* and *Antartick Circles*, the *two Tropicks*, the *two Colures*, the *Zodiack* and *Meridian*; and these *Lines*, and the several *Countryes*, artificially *Painted* on it, and all of them with their true *Distances*, from the two *Polar Points*, and to find the truth of those *Points*, he took two *little pieces* of a *Needle*, each of about *half an Inch in length*, and those he laid on the *Meridian line*, and then with *Brass Compasses*, moved one of them towards the *Artick*, which as it was moved, still raised it self at one end higher and higher

higher, keeping the other end fixt to the *Terrella*; and when it had compleated it Journy to the very *Artick Points*, it ſtood upright upon that *Point*; then he moved the other piece of *Needle* to the *Antartick Point*, which had its *Elevations* like the other, and when it came to the *Point*, it fixt it ſelf upon that *Point*, and ſtood *upright*, and then taking the *Terrella* in my Hand, I could perfectly ſee that the two *pieces* of *Needles* ſtood ſo exactly one againſt the other, as if it had been one intire *long Needle* put through the *Terrella*, which made me give credit to thoſe who held, That there is an *Aſtral Influence* that *darts* it ſelf through the *Globe* of *Earth* from *North* to *South* (and is as the *Axel-Tree* to the *Wheel*, and ſo called the *Axis* of the *World*) about which the *Globe* of the *Earth* is turned, by an *Aſtral Power*, ſo as what I thought *imaginary*, by this *Demonſtration*, I found *real*; and am convinc't by this, and other *Experiments*, That not only the whole *Earth* is guided by this *Aſtral Influence*, (fixt in the *Septentrional* and *Aſtral Points*) but every particular within the circumference of the *Terreſtrial Globe*, hath a *Magnetick tendency* to the *Septentrional Points*, naturally fixt in them, as may be Experienc'd in *Plants*, *Stones* and *Metals* (of which one might write a large *Volumn*) and it is commonly known, that in *Clay*, which have not been formerly dig'd (as I mentioned of that under my Houſe (in Title (*Clay*) being dig'd in pieces of 6 *Inches*, more or leſs in *length*, make them into *Rolls*, pointed at each end, and hang them with a *thread* in *Equilibrio*, and they will turn themſelves to the *North*, to ſhew that there is an *obedience* in all *Vegetables*, to the *Septentrial Aſtral* conduct, and ſo it may be evident on every other *Vegetable*; and though the *leſſer ſorts* of them can ſcarcely be experimented, in reſpect of their *minuteneſs*, yet in *Plants* of greater *bulks*, we may ſee the *predominancy* of the *North Point* in their *vegetation*, which is the reaſon, why *Plants* that are removed do not grow, or but very ſlowly, till they have recovered their firſt *poſition* to the *North*, by a ſecond compliance to the *Northern Magnetick Attraction*.

And

And it is not only thus in *Vegetables*, but in *ſenſitives* and *Rationals*, which I might inlarge: yet before I leave this *Diſcourſe*, I cannot but ſay ſomething of the *Conſtellation* that attends this *Artick Point*, which is called *Cynoſura*, pretended in the ſtories of *Conſtellations* (ſee Dr. *Hood*) to be the Daughter of *Caliſto*, and ſo had the name of *Urſa minor* (a Female) yet hath the tail of a *Dog*, and the end of that tail is called the *Pole-Star*, and this *polar Point* is called alſo *ſeptentrio*, from the *ſeven Stars* which hover about it, and thoſe ſeven *Stars* called *Septentriones*: Now the *Scithians* held the *polar Point* to be an *Iron Nail*(which is our *Axis*) and this they *adored* as a *God*, and before the *Load-ſtone* was known for *Navigation*, the 2 ſtars on the ſhoulder of this *Bear* or *urſa minor*, were *Directions* to the *Spaniards* inſtead of a *Compas*, *Card* or *Needle*: the like is ſaid of the *Constellation* (called *Helyce*, Siſter to *Cinoſura*) which is in the *Southern Point*, fixt in *urſa major*; and the ſeven chief of this *Conſtellation* are called *Charles's Wayne*, and are in the hinder part and *tail* of this great *Bear*; but I have ſaid enough of this, eſpecially concerning the *Scithians* belief, that it was *Iron* (probably not then knowing the Name of the *Load-ſtone*, and therefore called it *Iron* inſtead of *Load-stone*:) but to paſs theſe *Metallick* Parts of the *Terrestrial* Globe, and *celestial* Influences attending them. I cannot but recommend the Experience I have had (in lying in my bed with my Feet to the *North* and Head to the *South*) in my *rest*, *ſleep* and *dreams*, from other *Poſitions*, which I leave to the Conſideration of others; and return to the *Magnetiſm* of *Metals*; wherein all *Chimiſts* agree, That *Gold* is the *Magnet* of *Quick ſilver*, *Iron* of *Copper*, *Copper* of *Silver*, and *Tin* of *Lead*; and theſe *Magnetiſms* are ſtill guided by *aſtral Influences*, not only of the *Seven Peculiar Planets*, to the Seven Metals, but to the *Septentrional Axis* or *North Point*, which directs the Influences of the *Seven Stars* upon the *Seven Metals*. And now I ſhall conclude, and refer you to that admirable Experiment which our *Author* mentions of this *Jewel*, *l.* 4. *c.* 20. (colle-

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ꝏted from *Serapion* (an old Philoſopher) as alſo to *Cardanus*, (a known Author) who tells us what he had experimented, *viz*. That if a *Knife* be *touch'd* with a *Load-ſtone*, it will enter into any part of *Man's Body* without ſenſe of *Pain*, not only in thruſting it in, (which is common to all *Weapons* till the *Air* entreth the *Wound*) but alſo when it is drawn out.

Yet I cannot leave this pleaſant *Subject*, till I have imparted my own *Experiments*, in making this Jewel (for ſo *Erckern* deſervedly calls it) uſeful to inform us, as well of the *Ebbing* and *Flowing* of the *Sea*, as of the *Alterations* of the *Weather*, and to that End, I fram'd a *Model* or *Caſe* (as is here repreſented, but covered with *glaſs*) with a pair of *little wooden Scales* artificially hung by a *thread* to a thin piece of *Wood*, plac'd between the two *iron Points* of the *Loadſtone*, ſo as the two *Scales* may hang true under each *point*, and at each end of the *wooden Beam* of thoſe two *Scales*, I fixt two little pieces of *Iron*, to anſwer the two *points*, whereby the attractive power of the two *Iron Points* of the *Loadſtone* might operate its *attractive power* on the two *lower pieces* of *Iron* on the *Beam*, and then in one *Scale* I put in *Quick-ſilver*, and in the other certain little *weights* proportionable to the *weight* of the *Quick ſilver*; and on the *Center* of the top of the *frame* I placed an *Horizontal Dial*, with a Compaſs-Needle in it (ſuch are commonly ſold) and on each ſide of the frame (at equal Diſtances from the *Center*) I placed alſo upon an extended piece of thin *wooden board*, two more ſuch *Horizontal Dials* with *Needles*, ſo as the *Gnomon's* of all three, might anſwer each other in a *diametrical Line*. But having been hindred in perfecting my real *Apprehenſion*, of obtaining thereby many pleaſing and *uſeful Experiments*, I muſt refer the further account of them, till another time.

Sculpture XLII.



LOAM, *See* Clay.

LOTH, *See* Money.

LUMP, *l.* 1. *c.* 4. Teut. *Klumpen*. L. *Massa*, or a piece of any thing compos'd of *hard*, and *moist*, *mixt*, as *Clay*; &c. but in a mixture of Metals, 'tis called *Bolus*, and in mixture of *light Earths*, *Gleba:* and we also call a *fish* (which is common in our *Markets*) a *Lump*, in respect of its form, close, and compacted without a regular shape, and the word may well

well come from *Lumbus* or *Lumbricus*, by changing *b* into *p*, which two *Letters* differs not in their *labial utterance*, but by the addition of ſome other *Conſonant* or *Vowel:* alſo *Lumbus* is properly a *Store-houſe* (for *refuſe Metals* or *lumps* of *Metals*) and for other *Wares*.

LUTE, *Luting*, The *Teut.* calls it *Laum*, the *L. Lutum*, and they have a word called *Teſtudo*, which ſignifies not only the outward *Caſe*, or *belly* of a *muſical Inſtrument* called a *Lute*, but alſo *Clay*, and as *Lute* for *Clay*, and as *Lute* for a *muſical Inſtrument*, are *ſynonimus*, ſo they are in their *operations*, for as the Belly of a *Lute* ſerves for *reverberations* of *Sounds* which makes them *muſical*, ſo theſe *Lutes* or *lutings* ſerves in a *Chimical Notion* to *reverberate* or *repercuſs* the *ſpirits* of *Metals*, to make them *harmonious* and *uſeful* to *Chimiſts*, and conſequently to others who partake of their *Art*: and therefore the *Chimiſts* have a *Paſt* or *Clay* compounded with many *Ingredients*, whereof the chief is that which they uſe about the necks of their *Retorts*, &c. which they call *Lutum Sapientiæ*, ſhewing the *Wiſdom* of the *All-Diſpoſer*, that, that Earth which preſerv'd the *Metal* whilſt *quiet* and *undiſturb'd* in its *Bed* or *Mine*; is now made *uſe* of alſo, to keep its *ſpirits* from being *uſeleſs*.

MA M MA

MAN, *See* Vir.

MARCASITE, T. *Marcaſit*, L. *Pyrites*, and we *Marcaſite*, *Erckern* ſaith, It is rich in *Gold*, Dr. *Sal-*

mon,

mon calls it *Bismuth*, but I find it to be no where else, and makes it to be one of the *Recrements* of *Silver*; he agrees with other *Lapidists*, that there is both a *Goldish* and a *Silverish* *Marcasite*, the one yielding *Silver* the other *Gold*, however, they are excellent *Fire-stones* which we find in our *Mines* in *England*, but not so good for *Fire-locks*, as those which are brought from *Germany*, &c. And our *Marcasites* do neither afford *Gold* nor *Silver* worth the charge. *Diascorides* saith, That *Brass* may be made with composition of this stone, but that will not quit cost, because the *Marcasite* is not so soft as *Calaminaris*, but it may be tryed whither by mixing it with *Calaminaris* it will not give a nobler *Tinge* to *Brass*, and because it is not generally comprehended in *Metals*, but of an *Epicene* or *doubtful Gender*, I shall refer it to *Stones*.

MARBLE, *T. Marmelsteine.* L. *Marmor*, and *A. Marble*, which is but a little Variation from the general Name of *Marmor*, in Greek *Marmoras*, and we have several sorts of them, which consist of various *colours* and *uses*, and of these we have in *Devenshire*, and other Counties in *England*, good *white* and *black*, *brown*, *blewish*, *green*, *serpentine*, *yellow* and *grey*, faintly intermixt, and though, ours consists of various colours and degrees of hardness, yet they are short of those which are brought us from beyond Sea, or at least we think so; and as for the *Porphory* or red *Marble*, we have none of it that ever I saw: And the *Alabaster* which is a kind of soft white *Marble*, we have but little good of it, but of the *Lapis Lidius* or *Touchstone*, which indeed is a kind of *black Marble*, by which (being polish'd) Goldsmiths try their *Gold* without *Touch-needles*) and of these we have plenty, especially in *Darby shire*. (*See* Touchstone.) but the Occasion of *Erckerns* mentioning *Marble*, is because the stone is the hardest of any common stone, and so used by *Painters* to grind their Colours on, and for reducing *Metals* into *Dust*, by Metallists. See *Lime*, *Morter* and *Stone*.

MARK, T. *Merch*, L. *Marca*, signifying eight oun-

ces,

ces; the Word in *English* is applyed eight ſeveral wayes: See *Dictionarys.*

MARK CUTTING, that is, cutting of pieces of *Metal* which are mark'd out to be divided, ſo the Art is in dividing of the pieces to be cut, whereby they may bear a juſt proportion of weight one with another, and this is performed only with a cold *Chizel* (Dr. *Revell.*)

MARLE, T. *Marghel*, L. *Marga.* *See* Earth.

MATRAS, We retain the ſame Name. *See* Utenſils.

MEASURE, T. *Masz*, L. *Menſura* which are conſidered either of *Longitude, Latitude, Altitude* or *Profundity*: and theſe are ſometimes uſed diſtinctly, or joyntly, and ſo reduced to *Meaſures* of *Application*, T. *Zuphurgung*, and to *Meaſures* of *Capacity*, T. *Emphaung*, the firſt of the four (called *Longitude*, L. *Longitudo*) is termed alſo in T. *Masz*, A. *Length*, but the Latine hath variety of Words adequated to the extention of things to be meaſured, as the Meaſuring of *Lands, Geodeſia*, &c. 2. *Latitude*, T. *Breit*, A. *Bredth*, *broad*, and *large*, L. *Largus*, and *Latitudo*: 3. *Altitude*, L. *Altitudo*, T. *Die habe.* A. *Hight.* 4. *Profundity*, T. *Lage*, L. *Log*, and *Profunditas*, A. *Depth*, *deep*, and many other names, according to the proportion of *natural* or *artificial Contentures*, as *Cyathus* and *Coclearium*, &c. about which Dictionaries may be conſulted, for I ſpeak only of ſuch as are mentioned by *Erckern* for *metallick uſes*, of which ſome are *uncertain meaſures*, (viz. *a Fingers length* and *bredth*, an *hands thickneſs*, and *breath*, a *ſpan*, a *mans foot*, a *cubit*, &c. and ſome certain, *viz.* a *yard*, an *ell*, a *fathom*, &c. and of the *menſuræ Capacitatis*, ſome are alſo *uncertain*, as *Crucibles, Teſts, Cruiſes, Jugs, Pots*, &c. and ſome certain, as *Pints, Quarts, Galons*, &c. of which in order; And firſt of the *Finger*, T. alſo *Finger*, L. *Digitus*, which ſignifies the *length* and *bredth*, but we may read in *Georgius Agricola* (*de menſuris & ponderibus*, and other *Books*) that they conſiſt of ſeveral Proportions; and in *Gallen* (*de uſu partium*) of ſeveral uſes: and of

this word *Digitus*, *Holiock* makes no leſs than 24 *Obſervations:* but that which concerns this Subject, I have in part collected from *Cor. Agrippa*, that the *Thumb*, or firſt finger (Teut. *Daum*, L. *Pollex*) was dedicated to *Venus* and the *Moon*; and in Metallicks, lucky to *Silver* and *Copper*; the *fourth Finger* to *Mars*, and *lucky* to *Iron* and *Copper, red* (and *yellow*, artificial, that is *Braſs:*) the third called *digitus infamis* (I know not on what grounds) to *Saturn* and *Jupiter:* and lucky to *Lead, Tin, Silver* and *Gold:* The *ſecond finger* to the *Sun* and *Saturn*, lucky only to *Gold:* the firſt or *little Finger* to *Mercury*, and lucky to *Quick ſilver*, *Tin* and *Silver*; and theſe Notions are the chief *Foundations* of the Art of *Chyromancy* or *Palmiſtry*, ſo that by the *Fingers* and *lines* in the *hands*, the *temper* of men might be the better known for *Metallick* and *Chimical Purpoſes* (but the *Poet* who ever he was that made this Verſe)

Miles, mercator, ſtultus, bene nuptus, amator ;

applicable to the 5 *fingers*, had I conceive another proſpect, to ſhew that their Fate was at their *Fingers ends*, and by the Influences of the *ſtars* did direct them to their moſt *genuine Imployments*, whereby the *Chiromancer* might know to what one was by Nature adapted ; and accordingly, by that *Artiſt*, was directed to apply himſelf: but to paſs theſe *Curioſities*, it is writ by ſeveral Authors, that the *length* and *bredth* of the *fingers*, and ſo of the *hand*, gave the firſt Rules to the ſmaller Meaſures, the next is the *Span*, T. *Span*. L. *Spithama*, which conſiſts of three parts, *viz*. the *Thumbs*, (having three joynts) made one ; the *ſpace* between the *Thumb* and *finger*, making the other, and one of the *fingers* (having alſo three Joynts) making the third, ſo in all ſeven ; and though theſe *ſeven* do differ in proportion (the *ſpaces* and joynts being unequal) yet from the top of the *Thumb* to the top of either *finger* fully extended, was the *ſpan*, conſiſting of *ſeven* proportions : and 'tis obſervable, That *David* calls mans Life a *ſpan*,

which

which afterwards he explains, by saying the Years of Man are seventy, that is, seven decimals, or seven times ten, which is seven *spans*, so as the short *span* is from the *Thumb* to the end of the fourth or little finger, but if he had a long Life or Span *viz.* from the *Thumb's* end to the end of the middle Finger, it occasioned but pain in the extending it (from *police* the *Thumb* to *stultitia* the Fools *Finger*) which is the Vanity he speaks of, and as the spaces differ in proportion, so doth our several *Ages*.

The next is a *Foot*, *T. Fusz*, *L. Pes*, and though this natural *Foot* is an uncertain Measure, yet it retains its name, by a certain new Measure, called a *Foot-Rule*; and as to the first, I may say, that that *Foot* hath some *Anology* with *David's Span*; for by the *Span* the length of our Race is adjusted, and by the *Foot* that Race is to be run.

My next consideration is of a *Cubit*, which is accounted from the *Elbow* to the end of the middle *Finger*. *T. Cubit. L. Cubitus*, and the same word *Cubitus* also signifies a *Couch* or *Bed*, telling us, That before our Race is run, we grow weary, lay down on our *Cubit* (or *Couch*) to ease our *Limbs*, where we lean on our *brachial Cubit* or *Elbow*, and commit our Heads to be supported by our *Span*, or handle of our *Cubit*, and then we consider of our *abillity* or *disabillity*, in getting to the End of our *measure* of application, and the *Divine Prize* of our *Race* proposed to us.

Next for the *mensura capacitatis*, it consisted only of the contraction of the *palm* of the *Hand*, which was originally thought sufficient to hold so much as might quench the *Thirst* of *Nature*.

But when by excess we forsook the proportion of our first *Constitutions*, *Frames* and *Pugils*, some having *Fingers*, *Hands* and *Spans*, more than treble to the common *length*, and also their *Feet* a *Cubit long* (as *Pliny* tells us) and of the *Sciopides* (which *Munster* speaks of) that one Foot sheltred their whole Body against the *sun*, whereby in process of time, almost all Men

Men and Women became disproportionate to that perfect proportion (which I have mentioned in my *Volatiles* on *Adam*, from *Paulus Lovatius*) it was time to make some certain Measure both of *Application* and *Capacity*, least the large gripple *Hand*, should take away all from the lesser, and justify it from its large Dimensions, and therefore much to the Honour of the *Botanists* and *Galenists*; the *Standard* of *measures* was made from the *Barley-Corn*, which is so Noble a *Plant*, that it is observed (whether it grows upon a *fertile* or *steril* Soyl, yet) it continues one constant proportion of Measure (though it may differ in weight) and of these, three in length or six in breadth do make an *Inch*, whic hthe *T*.calls *ein dannim breit*, or the bredth of the *Thumb*, but in *Latine* the word is *Uncia*, which they apply both to an *Inch* of *Application* and to the *Ounce* of *Ponderosity*, still making the *Grains* of *Barly* or *Wheat* their Judges, both in *measure* and *weights*: now this *Uncia* or *Inch* of *Application* (as *Arrius Montanus* saith) consists of the breadth of *six Barly Corns*, thereby making bredth to have a Priority to length) but the later Writers, more properly make three *Barly Corns* in length, to be the length of an *Inch*, and twelve *Inches* of a *Foot*, and for Measure of *Ponderosity*, those who are for the *Troy Weight*, make twenty four full *Grains* of *Wheat*, and twenty *penny Weights* to be an *Ounce*, and twelve *Ounces* a *Pound*, which complyes with the measure of *Aplication* (or 12 *Inches* to the *Foot*) and this weight is used for *Gold* and *Silver*, &c. but others who are for *Aver-de-poise* weight allow 20 *grains* of *Wheat* to make a *scruple*, three *scruples* a *dram*, and 16 *drams* to an *ounce*, and 16 *ounces* to a pound: and these of Ponderosities do also comply with the *measure* of *Capacity*; for I compute that a Pound of *Troy*, viz. 5760 *grains* of *Wheat* will fill a certain Vessel which the Latines call *Hemina*, and the *English* (and in most *Europian Languages* a *Pint* (or *Pinte*) two of which makes a *Quart*, and four a *Pottle*, and eight a *Gallon*, so as the *Pound* of *ponderosity* and the *Pint* of *Capacity*

are

are both equal, and this agrees alſo with the Meaſure of *Application*,for a foot ſquare (on a cubical account, makes 144 Inches, ſo that for every one of the 144 Inches, 40 *grains* of *Barley* being allowed (as the juſt proportions of Capacity) it amounts alſo to 5760.

Now as (I have ſhewn) that the Latines do apply the ſame word *Uncia*, both to an *Inch* of *Meaſure*, and to an *Ounce* of *Weight* (and,it may be, for the Reaſon which I have given) ſo they apply the word *Ulna* to a *Yard*, *Ell* and *Fathom* in *Meaſures* (and ſo by *Dictionaries* jumbled together) whereby the genuine proportions of thoſe *Meaſures* are confounded; whereas a *Yard*, in *T. Girte*, and *L. Verda*, is applicable to any *Rod* or *Stick*, that is not appropriated to any certain rule of *Dimenſion* ; but as *Ulna* or *Yard* is fixt to a certainty, it ſignifies the length of 3 *Feet*, or 36 *Inches*; and an *Ell*, *T. Ellen*, and *A. Ell*, from *Elbow* (or *Ell-bone*, becauſe from that *bone* to the top of the middle *Finger*, is accounted a *Cubit* or a *Foot* and half) ſo 2 of thoſe *Cubits* makes a *Yard*,and 3 *Foot* and 9 *Inches* makes our *Ell*, and a *Fathom*, which is a *Meaſure* uſed about ſinking our *Mines* (called alſo *Ulna*) is two *Yards* : I might mention many more Meaſures of *Application*,uſed both above and under Ground, for the guiding and working of *Mines*, as alſo of other *Meaſures* of *Capacity*, as *Furnaces*, *Ovens*, *Pots*, *Pans*, &c. uſed for *Metals*: but I muſt not run too far upon this copious Subject; yet becauſe the *Ells* length, and other *Meaſures* (which I have named) are often mentioned by *Erckern*,and knowing that one *Ell Engliſh* is two *German Ells*, and the like of many other Meaſures; I intend this at firſt, only as a *Caution* to *Aſſayers*, &c. in making *Furnaces* or *Inſtruments*, according to the *German* or *Engliſh* proportions; which muſt be left to their Ingenuity to judge, what lengths or bredths are beſt ſuiting to their Operations.

MEDALLS. *T. Schraw grochen*, L. *Sigillum fuſile*, that is, a piece of caſt *Gold* or *Silver*, wherein ſome obſervable thing is repreſented, and is given by Princes, as *Memori-*

als of *Virtue*, or notable *Accidents*, and are accounted rather gratifying *Presents* than currant *Coyns*, and the word signifies also Counters, or something imprest on them, worthy of our account.

MELTER. *T.Schmeltzer.* L. *Fusor*, and by our *English*, *Mine-Workers*, (as at *Consumlock* and *Tallibant*, &c. in *Wales*) where they still retain the words Smelter and Smelting, which was brought into us 1. *Q. Eliz.* by one *Hosetter* a *German*; but in *fining* the *Metals* (after they are *smelted*) for distinction, the work is called *melting* and *remelting*, or *fining* and *refining*. *see* Alchimist, Metalls, Utensils.

MENSTRUUM, which we *Translate* Flowers, and *define* them to be *Purgatio frigidi & indigesti humoris quem natura quasi noxium ejicit*; now the word *Menstruum* as it relates to the *Female Sex*, (of which you may read in *Pliny*, *l.* 7. *c.* 15. is pernitious: but our *Menstrum* relates only to *Metalls* (which are all seven of the *Neuter Gender*) and the *menstrual* parts of them, do afford many great *vertues* and excellent *medicines*, and is the most sublime part of the *Scoria's* of *metalls*, and therefore also called *Flowers*, from its nature of *flowing* and shewing it self on the top or corners of the *Vessells*, where it usually resides.

MERCURY. *See* Metalls, Mineralls and Quickfilver.

METALS, T. *Metal* and *Ertz* and the *Metal-Worker Berck-hawer* and *Berck-werk* from *Berg*, *mons*: (wherein they are generally found) and *Werk*, *Opus*: and the Latin *Metallum* and *Metallarius*, A. *Miner*; the kinds of *Metals* are accounted *seven viz. Gold*, *Silver*, *Copper*, *Iron*, *Lead*, *Tin* and *Quick silver*, which I treat of in their *Alphabetical* Discourses: But as a Deputy Governour for the *Mines* Royal in *England* and *Wales*, I must aquaint you,

That, 1. as for *Gold*, (we have it not in *Sands* as in *Africa* or *America*) or so intermixt with other *Minerals*, that it will require the charge of *Separation*, and yet upon information of two Mines (one at *Pullox-hill* in *Bedfordshire*, and another in

little *Tawnton* in *Glocesterſhire)* which, as was pretended, contained a great quantity of Gold in the *Oar*, we granted two diſtinct *Leaſes*; but they proved not at all ſucceſsful: 'tis true, that among the *Tin-Mines* in *Cornwall*, they find little pieces of *Gold*, and ſeldom above the worth of 10 s. But this, as they dig for *Metal*, not in the *Metal.*

2. As for *Silver*, we have none, but intermixt with other Metals, eſpecially in *Lead*; And in the time of the late Wars, Mr. *Buſhel* ſet up Mills at the *Mines* in *Cardiganſhire*, and made out of thoſe *Lead-Mines* 20*l.* of *Silver* out of every Tun of *Lead*: and at *Shrewsbury*, a *Mint* by his Majeſties Permiſſion was ſet up, and then coined ſo much as paid that part of his Army, but it doth not now anſwer the Expence, or at leſt the knowledge of it is kept from us: and I am confident we have ſeveral *Lead-Mines* in *England* which would yield in every Tun, from 20*l.* to 80*l.* of clear *Silver*, and why this is not put in practiſe, I ſhall hereafter diſcloſe.

3. Of *Copper* we have very good and plentiful; *See* the word *Copper*; and why thoſe alſo are not wrought, I ſhall ſay more hereafter.

4. *Iron* is not in our *Patent*, only *Iron-Wire*, for the making of which, we have Mills at *Tinturn* in *Monmouthſhire*; *See more in Word* Wire.

5. Of *Lead* We have the Government both in *England*, *Wales* and part of *Ireland* (except the *Lead-mines* at *Dovegang*, in *Darby-ſhire*, and at *Mendyp* in *Somerſet-ſhire*; and alſo all other Mines that do not hold *Gold* or *Silver*, becauſe in thoſe two places, and ſome others, the *Lead* is look'd upon to be ſo poor that no *Silver* can be extracted from them, or at leaſt, not proportionable to the charge of *fining*, &c. of which you may ſee more in my Book called *Fodina Regalis.*

6. Of *Tin*, we have alſo the Power of *Inſpecting* them in all *Mines*, (except *Cornwall*, where they are managed by a peculiar Court, called the *Stanneries* from *Stannum*, the L. for *Tin*, of which you my ſee more fully in *Cambdens Britania*, p. 185.)

and

and for other *Tin-Mines* none do venture on them, becauſe of the great Product of *Corniſh-Mines*.

7. Of *Quick ſilver* we have very little or none in our *Mines*, ſo as we are forc'd to have it from beyond Seas, for which reaſon, whatever others account of this, as the ſeventh Metal, we cannot, becauſe it is not our *Native Metal*, and therefore we may rather chuſe *Antimony*, of which we have plenty; or *Braſs*, of which we may make ſufficient for our ſelves and Neighbours.

And there is another *Metal* which *Pliny* makes the ſeventh Metal, by the name of *Electrum*, containing upon *diſſolution* the fourth part of *Gold*, and a fifth of *Silver*; but we have none ſuch, yet ſuch a thing is mentioned in *Holy Writ*: ſee *Fodinæ Regales*.

And as for *Gems*, we often find in our *Engliſh Mines*, *Saphirs*, *Amethiſts*, &c. but very imperfect, for want of a ſtronger heat, as in hotter Countries, and about *Briſtol* in the *Callamine* Hills, there are plenty of ſuch *Stones* which imitate *Diamonds*, where I had the luck to find one of a good value, which I cauſed to be *cut* and *ſet*, and yielded a fine *ſplendor*.

MINERALLS. *T.* & *A.* *L. Mineralia*; theſe are *Metals* of a middle nature, between the 7 Metals and Stones; of which ſort, *Erckern* mentions theſe; *Allum*, *Antimony* or *Stibium*, *Armoniack*, *Arſnick*, *Brimſtone*, *Sulphur*, *Calaminaris*, *Cinabar*, *Talk*, *Vitriol*, *Nitre*, *Orpiment*, *Sandover*, &c. which I treat of alſo diſtinctly, in their *Alphabetical* Diſcourſes; but of all theſe we have ſo great plenty in *England* and *Wales*, that we need not have recourſe to Foreign parts for them, only in thoſe Countries where the *Metals* are not, I do not find any of theſe, or ſcarce any other *Mineral*, for it ſeems they are of a friendly nature not to part.

Mines, *Ertz-Grub*, from *Ertz-metallum* and *Grub fodere*: (which Word *Grub* we ſtill retain in *England* in the ſame ſenſe) *L. minera*, which relates to places in the Earth, where *Mettals* or *Minerals* are found, and I conceive the word *Mine*

is

is no other than a tranſlation of *Meus*, which the *Belgicks* write *Miine*, and the T. *Mein*, and A. *Mine*, ſo as doubtleſs they have all this ſence; that, that *Metal* or *Mineral*, which I find in the *Earth* is *Mine* (*Proprio Jure ſalvo Rege*) and this is ſtill a cuſtom at *Mendip*, and at the *Dovegang* before mentioned) however altred in other places; but here it only ſignifies the place or *Bed*, where the *Metal* or *Mineral* is lodged (without relation to the *Proprietor*) and they who dig for them are called *Miners*, it may be from *Minores*, being a People of leſſer Quality than thoſe above ground, ſo that in the *Romans* time, they were *Slaves*, or ſuch as for Offences, were (inſtead of other *Puniſhments* condemned to the *Mines* (*Goodwin*'s Ant.) *See* Alchimiſt.

Whilſt I was writing this, a Friend of mine came to me, and ſeeing me intent about this Book, ask't me why I left ſome other Subjects about *Parliaments*, &c. of which I Publiſhed but ſome parts, and others were expected? I told him, that I had not the opportunity of ſeeing *Records*, as I formerly had, and ſo did betake my ſelf to this of *Metalls*, being far more pleaſant, in reſpect it conſiſted of greater varieties than any one of the *Liberal Sciences* or *Arts*, and withal added, That there is a certain *Chain* in all our *Affairs*, by which we are *inviſibly guided*, of which the *Story* of *Joſeph* (ſold for a *Slave*, yet proved a *reliever* of thoſe who *inſlaved* him) is ſignificant, and though that *Story* doth not *quadrate* in all Mens *Actions*, to have the like *ſucceſs*; yet in this, to me it doth; for even thoſe *Notions* which I had of this *Subject*, which began with ſome *dangerous Attempts* (as I ſhall ſhew) have continued in my mind by *accidental Occaſions* and *Imployments*, till this very time, that by them I now find my ſelf full of *content* and *happineſs*, in the *Divine* and *Humane Contemplations* of them and their *circumſtances*; and now, Sir, ſaid I, give me leave to begin with the firſt link of this *Influential Chain*, which is held at both ends, by the Hand of *Divine Providence*.

Whilſt I was a ſmall Student of *Pembrook Hall* in *Cambridge*,

bridge, my good Mother (then a Widdow) consulted with Sir *Tho. Bendish* (a near Neighbour, and related to her) how I might spend the *Summer Vacations* to Improve my self, and thereby keep me from other *inconveniences*, which usually attend *Youth* (being then 17 years of Age, and of that *University* 3 years) Sir *Thomas* (who was a Practical Master of most *Sciences*, and insighted into all, and afterward *Embassador* to *Turky*, whose *Translactions* there, for 14 or 15 years, deserves a particular *History* (which in *Gratitude* I shall endeavor to perform) replied, *Madam* (said he) if you please to intrust your only Son with me, I will my self accompany him for two Months every year, till we have seen the *chief Varieties* which *England* affords, that he may be the better accomplish't for Foreign Travels; this favour was kindly accepted, so in three *Summers* more (before I left the *University*) he did perform what he promis'd, and the first Summer, our first Gess led us through *Darbishire*, which affords more pleasing *Objects* of *Art* and *Nature*, than any County of *England*; but I shall speak only of such things, as relate to the *subject* of this *Book*, and of my *entrance* into the concern of *Metals*; the *Theory* of which, with other *Rudiments*, my *Tutor*, Mr. *Boswel* (Brother to the *Boswel* that was then *Resient* at the *Hague*) had imprest in my thoughts: but as to the inducing *Practicks*, we spy'd several Wells near the *Roads* over the *Dovegang* (which abound with the poorer sort of *Lead Mines*) so we rode up to know the uses of them, and we were answered, That they were not called *Wells* but *Shafts* like *Wells*, only *Shafts* were square, and common *Wells* round, one made of *Wood* and *Timber*, the other usually of *Stone* or *Brick*, and whilst we were speaking, a Basket of *Lead-Oar* was drawn up (as our Buckets are to our Wells) I ask't, whether I might be safely let down in the Basket to see their Works? they assured me I might, and so with Sir *Thomas*'s consent (who in respect of his *Corpulency* thought not fit to lead the way) I was let down (not in the Basket) but by a strong stick, laid cross the *Hook* of the *Rope*,

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I sate on it between my Legs, one hand holding the *Rope*, the other guiding me from grating on the sides; so soon as I was down (being about 24 Fathom, or 48 Yards) the *Labourer* that waited for the *Basket*, was quickly informed of my intents, who presently, at my request (promising Reward) fetch't two Candles lighted, by which I saw, that there was no other passage than what I came down in, and by what I was to go into the *Mine*, but by that time we had gone half way, I told my *Conductor*, that I could not keep my Candle light, and at the same instant both Candles went out; Sir *said he, I pray stay here, and I will go fetch more Candles, for it is nothing but a damp*; at which words, my Spirits were much discomposed, yet I had so much left as to crawl back to the Shaft, and suck't in as much Air as relieved me; my *Conductor* soon returned with more attendents to light me, but I was very unwilling to return again, but gave them liberally something to drink, which the more obliged them to perswade me to see their Works, assuring me, That those Damps were not killing, but they had taken care (by keeping open the passage of their Waters) that no such Accidents should happen while I was there, and that they had good *Aqua Vitæ*, *Rosa Solis*, and good *Ale* to cheer me; with that, I went to the *Mine*, where their constant *Lamps* and *Candles*, which they lighted for my sake, did make the glitterings of the *Oar* very pleasant to me, by which I also savv their method of *Digging*, and vvas vvell *treated* vvith their promised *Drinks*, besides good *Beef* and *Bread*, so as their *liberality* encreased *mine*, and then I vvas attended to the *Shaft*, and so dravvn up as I vvent dovvn, and in my gentle passage, I thought of *Virgil's Distick*,

Eglog. 3. *Dic quibus in Terris, & eris mihi magnus Apollo,*
Tres Patiat Cæli spatium non amplius ulnas.

But I vvas not Edified by it, and so I came safe up, and gave a pleasing account to Sir *T. Bendish.*

From thence vve vvent to *Eldon Hole*, (being on the top

top of the higheſt Hill, in the *Peak*-Foreſt, which we computed to be above an 150 yards long, and more than an 100 broad, the bottom (as 'twas told us) not to be fathomed; and by prying, I had certainly fallen into it (for the ground is ſlippery) if I had not been caught hold of.

But Sir *Thomas* eſpying ſome work-men making of Walls, (for there and in other ſtony Countreys, they make their Incloſures of looſe ſtones (or ſlates) in ſtead of which in *Suffolk*, *Norfolk*, *&c.* they make Ditches, and plant them with *Quick-ſets*, on the ſides of the banks, but in *Devonſhire*, *&c.* they uſe high Mounds of *Earth* and *flag*, and plant them on the very top of the Mounds, and both are beneficial Fences by their Products, (whereas thoſe walls affords none) but he reſolving to try ſome experiment did ride to them, and by our generous Promiſes, perſwaded three of them, with their *Pick-axes* and *Tools*, to mount behind us, to the Hole; where firſt, they dig'd a pretty large ſtone, which we tumbled in, and the noiſe of its motion pleaſed us: then they dig'd a ſecond ſtone, as much as ſix of us could well roul in (for the mouth of the hole was declining) and preſently laid our ears to the ground, and we could tell eight ſcore diſtinctly, before the noiſe of its motion ceaſed, and then to our apprehenſions, it ſeemed to plunge it ſelf into water; and ſo we tryed a third ſtone, of more than the former Magnitude, with the like Obſervations, which pleaſed the Labourers (with the Addition of our Gratuity.)

From thence we went to *Buxton's* Wells, bath'd our ſelves that night, and the next morning (of which I ſhall ſpeak more in the word *Waters.*) we went to the *Devils Arſe of Peak*, (ſaving your Reverence, as the learned Mr. *Cambden* expreſſeth his Civilities) where we ſaw a large hole, in the bottom of a ſteep hill, on the top of which ſtood an antient decay'd *Caſtle* (of which you may read more in his *Britania*) We had Candles, and ſaw as much as we could, till we were hindered by running *Streams*. Now of theſe two *Holes*, there are many *fabulous* ſtories; but ſome years after, upon viewing other

other Mines, and their *Shafts* and *Audits* to them, I apprehended that this *Eldon-hole* vvas an antient *Shaft* (made in the *Roman's* time) to a *Mine*, and that the *Devils arse* was the Mouth of an *Audit* to that *Mine*, and I am the rather of that Opinion, because I conceive, That the *Level* of the *Water* (vvhich stopt our further passage into that *Audit*, *Arse* or *Fundament* of the *Mine*) is level with the Water at the bottom of *Eldon-Hole*, and the word *Arse* may be applyed upon two accounts, first that upon a Mistake of the word *Arse*, for the Latine word *Ars* or *Art*, where the *Romans*, when they brought out their *Oars* of Lead, and probably made *Silver* of it, and did thereby shew their *Ars Metallica*, which the *British* not being *latiniz'd* cal'd *Ars*, and as an Art which they did not understand, they (as the Vulgar do yet) attribute it to the *Devil*, and so call'd the *Devils Arse* or *Ars diabolica*; (as we see in the Weapon *Salve* or Sympathy *Pouder*, the knowledg of which two great *Secrets* were attributed to the *Devil*, as we may see by *Godelmanus*, and other Books, till they were convinc'd of their *Error*: or it might come from *Arce* the *Ablative* of *Arx*, Latine for a *Castle*, and probably this *Castle* was originally built to protect the *Treasure* which came out of the Hole under it, or to keep the *Miners* in aw (there being the like *Castle* at the *Roman Mines* on the *Darren* Hills in *Wales*) and possibly the Governour of it being severe in his Duty, the Vulgar (as they are apt to do in any regular Government) might call him, and it, *Diaboli Arx*, and since opprobriously the *Devils Arse*, but I have said enough as an *Apology* for the *Word*, and for my *Opinions* therein.

I conceive they are not so fabulous as those which are told in the *Country* about these two *Holes*.

Here my Friend interrupted me, and ask'd how *Eldon Hole*, (from the usual proportion of a *Shaft*) came to be so large as I described it; I answered, That *Gutta cavat lapidem*; and if one *drop* by *often cadency* will make a *hole* in a *stone*, it is easy to be credited, That the fall of Clouds of Waters, (from the

time that this was a *Shaft*,being about 2000 years) might well widen it,from *Virgil's* dimenſion of 3 *ulna's*,*yards* or *ells* ſquare, (for I conceive he meant the *Shaft* of a *Mine*) to this *great Dimention*,at which he ſmiled: and ſo I went on; Sir,ſaid I, the next two Summers,we made a further *Inſight* to ſeveral *mines* &*Caves* with no little danger(which I refer to otherDiſcourſes) and alſo their ſeveral wayes in their operations at thoſe*Mines*.

Some few years after, the Wars came on, where my *Speculations* were improv'd by the information I had at *oxford*, that the *Royal Mines* in *Wales* were very helpful to his late *Majeſty* during thoſe *Civil Wars* (as I have ſhewn.) And,after the *Wars* viz.1650. telling theſe *Stories* to Mr. *W. B.* he told me, He had a ſhare in the Society for the *Mines Royal*, and deſired to transferre it to me, in truſt, which I accepted, and did execute it, for near 10 years after ; and then reſign'd it, but the *Societys* finding my Diligence, and *Inſight* into that Affair, were pleaſed to beſtow two quarter parts on me to continue me, and as a Teſtimony of my *Gratitude*, in *Anno* 1670, I writ a Book of their *Priviledges* and *Rules*, which I called *Fodinæ Regales*, and dedicated it to them, with a promiſe to proceed in the publiſhing of *Erckern*, which now I have done, and ſome other pieces which I hope to do.

And thus, Sir, ſaid I to my Friend, I have given you an Account of ſeveral Links of this *Chain*, which guided me into this *Laborinth* of *Metals*: But to get out of it, that which I aim at, is to write a little more of their Products, and to offer ſome Expedient how the *Mines* may be made more profitable to his Majeſty,and to other Proprietors, with ſome Advantages to the *Societies*, which, God willing, I ſhall perform in due time, and then we parted, he wiſhing me good Succeſs to my Endeavours.

And ſo I went on, where I left, namely to Acquaint the *Reader*,that *Erckern* doth tell us of ſeveral *Mines* in *Germany*, p. 28. eſpecially in *Auſtria*, p. 285. *Bohemia*, *Belgia*, *Flanders*, p. 170. *Hungary*, p.103. and *Saxony*, p.77. he al-

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ſo mentions the particular Cities and Villages to which they belong, and where they are refined *viz.* at *Bruſſells*, p. 170. *Cracow*, p. 208. *Cuttenburgh*, p. 142. *Friburgh*, p. 6. *Galmay*, p. 285. *Goſlar*, p. 78. *Heſſen*, p. 285. *Holland* p. 170. *Joakims-Valley*, p. 34, *Iſlenburgh*, p. 285. *Cauſingen*, p. 285. *Knien*, p. 100, (where he ſaith the *Mines* contain good *Duke-Gold*) *Lick beter*, *Manbren*, p. 4. *Meichſen*, p. 4. *Miſ ia*, p. 6. *Norimberg*, p. 86. *Saxen*, p. 4. *Schwath* *Slackenward*, p, 83. *Sheſron*, p 4. *Sorath*, *Suevia*, p. 285. and *Suabem* ---- *Tyrol*, p. 285. *Villach*, and *Waldenburg*, and many other places which he and *Geographers* do mention (See *Heylen*) and therefore I think fit alſo to mention the Counties of *England* & *Wales* wherein *Royal Mines* have been diſcover'd to us, *viz.* in *Bedforſhire*, *Cheſhire*, *Cornwal*, *Cumberland*, *Darbyſhire*, *Devonſhire*, *Dorſetſhire*, *Durham*, *Eſſex*, *Gloceſterſhire*, *Here-ford-ſhire*, *Kent*, *Lancaſhire*, *Monmothſhire*, *Notinghamſhire*, *Northumberland*, *Rutland-ſhire*, *Shropſhire*, *Somerſetſhire*, *Staf-fordſhire*, *Suſſex*, *Warwick ſhire*, *Weſtmorland*, *Worceſterſhire*, *Yorkſhire*, and in all the twelve Counties of *Wales*, ſo as of the 52 Counties there are 38 of them *Metallick Counties*, but in many of the reſt, *viz.* *Bark ſhire*, *Buckinghamſhire*, *Cam-bridgſhire*, *Hampſhire*, *Hartfordſhire*, *Huntingtonſhire*, *Lei-ceſterſhire*, *Lincolnſhire*, *Middleſex*, *Norfolk*, *Northamp-tonshire*, *Oxfordshire*, *Suffolk*, *Surry*, *Wiltshire* there are good *Minerals*, but in ſome of them neither *Metal*, *Mine-ral* or good *Quarries*, and yet they are recompenced ſome other wayes.

Now, though *Germany* abounds in *Metals* and *Minerals*, yet *Erckern* acknowledgeth that they have a better ſort of *Cop-per* and *Lead* from the Mines in *Poland* (as it ſeems *p.* 268.) and a better ſort of *Gold* from *Hungary*, *p.* 108. *India* and *Æ-thiopia*, p. 101. and a better ſort of *Lapis Calaminaris*, (and other good *Oars* of *Metal*) from *England* (which *Erckern* calls *Britain*, p. 286. and a better ſort of *Soap*, to contemper *Me-tals*, from *Venice*, than their own, ſo though we have as good

Mines

Mines in *England*, yet we are forc'd (for want of a constant use of them, and thereby improve our *Knowledg*) to borrow the Products of their *Mines*, and indeed our chief *Knowledg* how to work them (as I find by our *Records*) and they may well have greater Experience than our selves, because *Erckern* tells us, That the Mine at *Goslar*, formerly under the D. of *Saxony*, but now under the D. of *Brunswick*, hath been in constant working for above 700 years, to his time: and *Heylen* tells us, That the D. of *Saxony's* Mines, (the Territories not so big as *England*) yields to him above 130000 *l.* yearly; now why ours are not made so beneficial to us: I attribute it either to Reasons of *State*, or want of *Knowing* the several *Arts* which belong to the *Working* of them.

MINT, *T. Muntz, vel locum ubi monetam cuditur*, L. *Monetarium, Officina monetaria, Taberna monetaria, Officina Cusoria*, A. it signifies with us, (as *Cowel* renders it) the place where the the *King's* Coyn is *formed*, be it *Gold* or *Silver*, which is at this present, and long hath been, in the *Tower* of *London*, though it appear by divers *Stories*, and other *Antiquities*, that in antient time the *Mint* was at *Callis*, *Ann.* 21 *R.* 2. *cap.* 6. and *An.* 9. *H.* 5. *stat.* 5. *cap.* 5. the Officers belonging to the *Mint*, have not been alwayes alike: at this present they seem to be these; the *Warden*, who is chief of the rest, and is by his Office to *receive* the *Gold* or *Silver* of the *Goldsmiths*, and to pay them for it, and over-see all the rest belonging to this Function (his *Fee* is an hundred pounds *per Annum*:) the *Master-Worker*, who receiveth the *Gold* or *Silver* from the *Warden*, causeth it to be *melted*, and delivers it to the *Monyers*, and taketh it from them again, when it is made (his *Allowance* is not any set *Fee*, but according to the *pound weight*:) the *third* is the *Controller*, who is to see that the *Money* be made to the just *Assize*, to over-see the *Officers* and *Control* them, if the Mony be not as it ought to be (his *Fee* is one hundred Marks *per Annum*:) then the Master of the *Assay*, who *weigheth* the *Gold* or *Silver*, and see-

ſeeth whether it be according to *Standard* (his Yearly *Fee* is alſo one hundred Marks:) then the *Auditor* to take the *Accompts*, and make them up (*Auditor*-like:) next the *Surveyor* of the melting; who is to ſee the *Gold* or *Silver* caſt out, and not to be altred after it is delivered to the *Melter*, which is after the *Aſſay-Maſter* hath made trial of it; then the *Clerk* of the *Irons*, who ſeeth that the *Irons* be clean and fit to work with; next the *Graver*, who *Engraveth* the *Stamps* for the *Moneys*; then the *Smiters* of *Irons*, who (after they be *Engraven*) ſmiteth them upon the Money; next the *Melters* that *melt* the *Bullion* (that is, *Gold* or *Silver* in the *Maſs* or *Billot*) before it come to the *Aſſaying* or *Coyning*; then the *Blanchers*, that do *aneal*, *boyl* and *cleanſe* the *Money* (reducing it to its natural *colour*, *viz*. to *yellow* if *Gold*, and to *white* if *Silver*:) next the *Porter* that keepeth the *Gate* of the *Mint*; then the *Provoſt* of the *Mint*, who is to provide for all the *Monyers*, and to over-ſee them: laſtly, the *Monyers*, who are ſome to *ſheer* or *clip* the *Money*, ſome to *forge* it, ſome to *beat* it abroad, ſome to *round* it, and others to *ſtamp* or *coyn* it (their Wages is not by the Day or Year, but uncertain, according to the weight of the Money *Coyned* by them:) Other Officers have been in former times, now uſeleſs, becauſe Mills are uſed for that purpoſe, and the *Art* of *Mintage* and *Aſſaying* of *Metals* is much improved, by his Majeſties great *skill* and *inſight* into that Affair. *See* Coin, *&c.*

Now it ſeems by *Cowel*, That *Mints* were erected in moſt parts of *England*, but he mentions no particulars, except *Cumberland*, *Northumberland* and *London*, (ſee his Title *Moniers*) yet under the word *Mint*, he cites the 21. of *R*. 2. *c*. 16. and 9. of *H*. 5. *c*. 5. in which two Kings Reigns, the *Mint* was removed to *Callis*, being then under the *Engliſh Juriſdiction*; and I do not find it, either before or ſince, removed from the *Tower* of *London*, except in the late Uſurpation, and then his Majeſty cauſed one to be Erected at *Shrewsbury*, to *Coyn* the

Silver which was brought thither from the *Mines* in *Wales* (of which I have ſpoken before.)

MISPICKLE. T. *Miſzpickle*; I know no other word for it, being mentioned as a *kind* of *Oar*, diſtinct from others (*l.* 1. *c.* 2. *ſ.* 11. and *l.* 3. *c.* 1. *ſ.* 6.) but it may be derived from the next word *Miſſy*. See *Oars*.

MISSY. T. *Miſſy*, A. & L. *Miſy*. which *G. Agricola* from *Pliny*, calls *Atramentum ſutorium*, or *Shoe-makers Black*; but *Pliny* makes it a kind of *Vitriol*, and is confeſſed to be a *mineral*, and the *Oar* ſparkling like *Gold*; ſo as I conceive *Miſpikle* is an *Oar* of the ſame *nature*, only ſpotted; which the T. calls *ſpickled*, A. *ſpeckled*: ſo it is a kind of *Miſſy-Oar ſpeckled*.

MONEY. T. *Muntz*. L. *Moneta*, *Pecunia*, &c. ſee *Coyn*, *Metals*, *Meaſures* and *Weights*; and this *Money* is proportioned from 20 *Grains* of *Barly Corns*, which make a *ſcruple* (according to Phyſicians terms) or a Penny according to *metallick* terms; and 20 pennyes make an *Ounce*, and 12 *Ounces* (either of *Gold* or *Silver*) makes a *pound* (according to the *Trojan* computation, and thence called *Troy* Weight:) as for *Haver du-poiſe* weight, or *Haver* weight, it hath 16 *Ounces* to the *Pound*, and *Metals* and *Gems* are not concerned with it: however, the *Barly-Corn* bears the ſway in both; ſo the poor *products* of the *ſuperficies* of the *Earth*, ſeems to give *Laws* to all our *ſubterranean Treaſures*, both before, and when it is made *paſſable*, and *communicable* or *currant Money*; whereby I conjecture, that the word *ſterling Money*, may not improperly be derived from *Sterilis*, or *natural unfructified Ground* (which is proper for *Barly*) whereas *fertil*, *dung'd*, or *artificial Grounds*, makes it more *ponderous*, and its *Grains* not of ſo true a *ſtandard* for *Sterling Money*, as thoſe of a more *Natural Earth*.

Now to all *Silver* or *Gold Money*, there is an *Allay*; that is, a taking away part of the *fine Metal*, and adding the like part of the *baſer*; that is of *Copper*, &c. and this is done upon two accounts: firſt, that the *baſer Metal* may make the *finer* to be

more

more apt for *Coynage*; the other is, that the *Soveraign* of that *Government* where it is so *allay'd*, may by the *deduction* or *allay*, be paid the full charge for the *Coynage* or *Minting* of it: Now the less *allay* that is put to the *Coyned Gold* or *Silver*, doth render the *Government* the more *Honourable*, and the *Soveraignty* of a greater *Esteem*, than in other parts, where they have greater *allay* (*Vaughan.*)

It is good for a Traveller to be skillful in the different *allays*, whereby, as a Friend of mine told me, That he carried out an 100 *l.* with him, and with his art of *Exchanges*, in Countrys where *allays* differ'd, he bore his *Charges* of *Travel* and brought his *stock* home again; however, this *Mony* thus *allayed*, is called *Coyn*, when the *Soveraign Stamp* is upon it (which is a *Legal Stamp*) and every *Soveraignty* useth a different *Stamp*, as here in *England*, and in the *Empire*, *France*, *Spain*, &c. proper to its *Soveraignty*; and every piece of *money* so *stampt*, hath almost a different *allay*: yet all Princes do agree in severe, yet just, *Penalties*, for *Counterfeiting allays* or *stamps*, and make it, as in *England*, *High Treason*. vid. *Coke*. 2. *In*. *p*. 575.

MONYERS. see *Money*, lately called *Bankers*.

MORTAR. T. *Gips*. L. *Gibsum*, made of *Water*, *Calx viva*, *Lime* and *Sand*, and used in all sorts of *Structures*, to *cement* Bricks or Stones. *See* Calx and Sand.

MORTER. T. *Morsell*, *Morsuer*. L. *Mortarium*, which *Minshaw* says, is *morte earum rerum quæ in illo teruntur*, and though we write one with an A. the other with an E. for distinction, yet the *Beaters* for that, and *Pestles* for this, makes *Minshaws* discription serve for both of them. *See* Sand and Pestle and Sculp. II. and IX.

MOULD. T. *Model*. L. *Modulus*. A. *Frames*, &c. *See* Utensils.

MULLET, T. *Mallen* & *schleifer*, L. *Molarius*, *marmorius*, a little flat piece of *marble stone* on which *Painters* grind their *Colours*, and *Metallists* their *Metal* to *dust*, from *molare* to distinguish it from the *Mullet* fish.

MUNK,

MUNK, T. *Munich*, which I conceive, comes from the L. *Munitus* (and not from *Monicha*) as an *Instrument* that guards and strengthens the Operation of *Metals*, by covering it from the Air, and therefore though A. write it *munk*, it were more proper to be writ *munt*, as an abreviation of *munitus*.

NE NE

NEALING or *Anealing*, T. *Abgeadnet*. I find it not in our Dictionary, but in *Cotgrave* it is *Nelleure*, and signifies a *vernishing* and *enameling*: the difference is in the Arts; that *enameling* is upon solid Bodies, as *Gold*, *Silver*, &c. but *anealing* is usually apply'd to the *coloring* of *Glass*, such as we had in former times, and still have in Church Windows, in excellent Varieties, and sometimes 'tis used for *tinging* or *coloring* of *Stones*, where it is done by *fire*, but here the word is applicable only to such *Coppels*, *&c.* which are covered and *strengthned* with *Clar*, for resisting the fire, and the manner of *anealing* them, is allwayes done by a *gradual*, and not a *violent* heat. *l.* 1. *c.* 10. *s.* 1. *See* Amel *and* Clar.

NEEDLE, And it is applyed to several things, and hath thereupon several *Names* in several *Languages*, but in *Latine* it is called *Acus* from its *Acuity* or sharp point, (and is sometimes applyed to ingenuous *satyrick* Wits;) the *French* call it *Aquila* quasi *Anquilla* (as *Minshaw*) because it is proportioned like an *Eel fish*, but the *German* here calls it *Nadelen* from *Naeden* or *Naen*, *suere*, i. e. to sow or stitch together,

ther, and this word *Nadelin* is the neareſt to our word *Needle.*

Which word being uſed in the *New Teſtament*, to ſhew the difficulty of a Rich man to enter into the Kingdom of Heaven: It ſtands ſuch men in hand that deal in Metals (in order to make themſeves rich) to ſee how far they are concern'd in the *impoſſibility* mentioned in the *Text*, now St. *John* makes no mention of a Needle, but St. *Matth.* ca. 19. ver. 24. ſaith, *It is eaſier for a Camel to go through the eye of a Needle,* (per foramen acûs tranſire, *Sept.*) *than for a rich man* (that is he that abounds in Money, made of *metals*) *to enter into the Kingdom of God*; and ſo St. *Mark*, cap. 10. v. 24. and in St. *Luke* 18. 25. but the Latin is *foramen acûs, the Needles eye*, which, my Author (whom, I cannot readily call to mind, or elſe I ſhould own him) ſaith, there was a little *Poſtern Gate* in the *Wall* of *Jeruſalem*, which was called *foramen acûs*, or the *Needles eye*, through which a *Camel* could not paſs without Kneeling (which ſaith *Pliny* Camels are taught to do) ſo as by going on their *Knees*, a *Camel* might paſs through that *Gate*, which otherwiſe it could not do; and ſo the *Story* alludes to a *rich* and *humble* man, who by *Humility* may eaſily enter into the *Kingdom of Heaven*, but not a proud *rich* man, that will not ſtoop, but puts more confidence in his *money* or *metals*, than in an *humble* or *devout* mind, which is imply'd by the bending of the *Knees* of the Camel.

Now, this word *Needle* is once only uſed in the *New Teſtament*, by thoſe three *Evangeliſts*, and no more, but it is uſed oftner in the *Old Teſtament* to other purpoſes, and is alwayes joned with the word *work*, as *Needlework*. But in the Tranſlations of the *Oriental Languages*, the *Tranſlators* differ, for Dr. *Walton* in his *Polyglot* renders *Needle-work*, *Opus recamantis, Opus Polymatrii, Opus Varietoris, Opus picturarum, Opus Imaginum*, ſo as there is nothing of a *Needle*, but from the *Chaldee*, and there he tranſlates it *opus acu pictum*, and from the *Arabick* which he renders *Phrigianum*, and *Junius* and *Tremelius* (publiſhed before that *Poliglot*) in every place of the

Old Teftament, where the word *Needle-work* is ufed (as in the 26, 27, 28, 36, 38, and 39 Chapters of *Exodus*, and in the 5th of the *Judges*, and in the 45 *Pfalm.* ver. 14. for it is ufed in no other places) do follow the *Chaldee* and *Arabick*, in the words *Opus* and *Artificium*, but not in *acu pictum*, yet the two moft eminent *Poets* of their time in *England* and *Scotland* concur'd in the uniting of thofe words, for *Sandys* writes thus, *Pfal.* 45. 14.

Shee fhall unto the King be brought,
In Robes with Phrygean Needle *wrought.* And

Buchanan
*Dives opum,*dives Pictai *veftes & auri.*

(where note he ufeth *Pictai* for *pictæ*, as *Virgil*, *Lucullus*, and other Latine Authors do oft change the Diphthong *æ* for *ai*) fo that *Sands* hath the *Needle-work* in the word *wrought*, and that he calls *Phrigian* (from *Phrigia*, where it is fuppofed that Art was firft taught) anfwering the *Tranflation* of the *Arabick*: and *Buchanan*, *Pictæ* anfwering the *Tranflation* from the *Chaldee*; and thefe *Needle-Works* are there alfo called *fæminalia torta*, becaufe the Art is moftly ufed by *Women*, and therefore *Acus* for a *Needle* is properly declin'd in the *feminine gender*.

Now, the fhape of the Needle was taught us by *Nature*, for there is a fifh which I have often feen on the Coaft of *Suffolk*, which commonly comes there with the *Mackerel*, and differs only by having a *fnout* of about 12 Inches in length, being a firm *bone* in the fhape of a *Needle*.

Now, whether this be one of the *Needle fifhes* mentioned by *Pliny*, l. 32. and call'd *Acicula* (and one of the 176 *forts* of *Fishes* which he there enumerates, or the *Acus Ariftotelis*, or the *Acus Opiani*, mentioned by *Jonston*, lib. *de Pifcibus*, I cannot fay; but *Cooper*, from *Pliny* (yet I find it not in *Pliny*)

Pliny) deſcribes it juſt like the *Suffolk Fish*; *Acus*, ſaith he, is a Fiſh *long*, *ſmall*, and *ſmooth*, on the back colored as it were with *green* and *blew*, his Beak *long* and *ſharp*, and makes this of the maſculine *Gender*, and we call it the *Needle fiſh*.

Acus alſo ſometimes ſignifys an order in *Battle*, and ſo called *Acus belli*, when they are at point of Fighting, *Acus* alſo ſignifys the *ſpiral* parts of *Wheat*, *Oates*, *Barly*, &c. being like ſo many *Needles*, and not *chaff*, as moſt Dictionaries have it: And there is an *herb* called *Acus paſtoris*, or *Acus moſchata* being full of *Prickles like Needles*, but vulgarly 'tis call'd *Venus's Comb* or *Charvell*, the chief Virtue of which is to provoke *Luſt*, and ſo may be called *Acus libidinis*. There are many other Inſtruments of this name, *Needle*, which are uſed by *Carpenters* to cripple, graple, or joyn houſes together, and *Thatchers Needles* to thatch withall, *&c.*

But the chief Application of this word *Needle* is in *Navigation*, and there called *Acus Navigatoria*, or the Mariners *Needle*, or *Compaſs*, in reſpect that he compaſſeth the Seas, by the Virtue which it borrows from the *Loadſtone*; (of which I have ſpoken at large) and is of ſuch a tranſcendent Nature, that which way ſoever the ſhip moves, ſtill the head of the *Needle* fixeth it ſelf to the *North*, and the other point to the *South*, and this admirable Inſtrument hath no other title in our Language than *Needle*: I hope that none that ſhall read this long Diſcourſe of *Needles* will think it *needleſs*: but it was from *Erckern's Touch-needles* which he calls *Streich Nadelen*, and *Agricola, de re Metallica*, calls them ſometimes *Gold*, or *Silver* or *Copper Needles*, by the touch of which the worth of each *Metal* may be known, and they differ in the making, forming and ſhaping of them, as may be ſeen in *Sculpture* 8. & 18: and in *G. Agricola*, p. 199. which ſhews them in an *acular* or *Needle*-form.

Now, there being great trouble and nicity in making of them either way (for indeed it is one of the moſt curious pieces about the *Metallick Chimiſtry)* therefore the *Chimiſts*, *Gold-*

Goldſmiths or *Tryers* of *Gold* and *Silver* (to ſave trouble) do make uſe of a *Touchſtone*, being a kind of ſoft *Marble*, of which you may read more in *Stones*.I read but of one ſort of *Needles* more, which *Cambden* ſpeakes of, in his *Britania*, p. 700. *viz*. of a *Vault* under the Church of *Rippon* where there was a little hole, called St. *Wilfred's Needle*, through which a virtuous Woman might paſs with eaſe, but if ſhe were otherwiſe diſpoſed, ſhe did not paſs, but ſtayed below to be tryed of what Metal ſhe was made.

NILE, or the River *Nilus*. See *Gold*, *Metal*, *Mine*.

NITRE, a light, ruddy, yet white ſubſtance, full of holes like a *Spung*, and reſembling common Salt almoſt in colour; but quicker of Taſte, and is miſtaken by ſome for *Salt-Petre*; there is alſo a *Nitre* which comes out of *Africk*, of a *purple Colour*, but that which is now commonly ſold to us for *Nitre*, is *Salt Petre* refined and candied, and uſed ſometime in ſtead of *Borax*.

NOSEL, See *Utenſils*.
NUMBER, See *Arithmetick*.
NUT, See *Meaſures*.

OA O OA

OARS. T. *Erkes*. A. and Saxons, *Oar*. Danes, *Aare* and *Aaure*, the L. *Metallum Crudum* (*Skinner*) for I find no ſingle word for it,unleſs it be *Fodina*, which may be applyed to other dig'd things; but in our *Patents* for the *Mines Royal*, is writ *Ewre*, which ſig-

nifies

fies a place where *Water* is, for *Water* allways attends *Metalls*, and from thence the *Ewres*, which was formerly made of *Silver*, to pour *Water* into Basons, is called *Ewre*; and from thence comes *Sewer*, or, one that takes care for drawing of *Water*, where any Land or place hath more than is necessary, but generally in our *Language*, we call that which is digg'd from the *Bed* of any *Metal*, *Oar*; as if one should say *O admirablilia Rerum Metallorum*, for most of our *Monosyllables* are but *abstracts* of many words *compacted* into one, as may be seen in Sir *Edward Coke's Instit.* and other *Learned Etymologers*; also we usually call those *Oares* wherewith *Watermen Row* their *Boats*, aluding to the *pains* and *labour* which is used with the Arms in both *Professions*, by *Digging* and *Rowing*; there is also *Leimster-Oar*, of which I have spoke, under the word *Flocks*: but of the *Metallick Oars*, there are as many sorts of them, as there are Metalls: yet I find but four Latine Words, and those compounded; *viz. Balluca*, for *Gold Oar*: *Pomphilix*, for *Copper* or *Brass Oar*: *Stricturæ*, for *Iron Oar*: and *Plumbago*, for *Lead Oar* (*Holliack*) and therefore *Erckern* sometimes calls the *Products* of *Metalls*, from the Mines *Erks* and *Oars*, and sometimes *Stones*, *Goldt-stein*, for *Gold Erk* or *Oar*: *Silver-stein*, for *Silver Erk* or *Oar*: *Kupfer-stein* for *Copper Erk* or *Oar*: *Bley-stein* for *Lead Erk* or *Oar*: *Zein-stein* for *Tin Erk* or *Oar*: *Speiz-stein*, for *Quick-silver Erk* or *Oar*: *Ein-stein*, for *Iron Erk* or *Oar*: *Slack-stein*, for *Steel Erk* or *Oar*: But I conceive, that when he useth the word Erk, it signifies the Oar joyned with the *Excrement*, and when Stein, it signifies the *intire Metal*, separate from the first *crude* and *heavy Matter*: Now the *Names* that he gives for *distinction* of Oars are these (as they are variously dispersed in his V. Books) *viz. Blent Oar*, *Cat-silver Oar*, *Cobolt Oar*, *Copper* and *Coppery Oar*, *Crude Oar*, *Fleaky* or *Flacky Oar*, *Float oar*, *Fresh Oars*, *Glassy Oars*, *Glittering*, *Glistering* and *Glimmering Oars*, *Gold* and *Goldish Oars*; also *white*, *red*, *brown*, *Goldish Oars*; *Grey Flints*, called *Iron-man-Oars* and *gross*

Oars; *horny*, *hard*, *harsh Oars*, *Lazure Oars*, *Leadish* or *Lead Oars*; *mild* and *muddy Oars*, *Slate-stone Oars*, *Silver*, *silvery*, *spady*, *sparkling*, *spelter*, *spizy* and *sulphury Oars*; *also Talk*, *Tinny Oars*, *Washt* and *Wolferan Oars*; and many others, which are dispersed in several parts of his V. Books: and some of them discoursed of here also, in their *Alphabetical* order; especially where we retain the same *Apellations* for the like *Oars*, to which the *Reader* is referred.

ORANGE. *Orpiment*. *See* Colours.

OVEN. T. *Offen*. L. *Furnax*, and the same words are used for *Furnaces*; but *Kilns*, which are a kind of *Ovens*, are called T. *Calk* and L. *Calcaria* and *Furnax*: of the several sorts of these, you may see in the *Sculptures*, in their proper pages: *viz*. the *Athanor* in *page* 2. 123. 161. 172. 177. 185. 207. a *Wind Furnace*, *p.* 2. 56. 200. an *open Furnace*, *p.* 2. an *Assay-Oven*, used by the ancient *Refiners*, *p.* 13. an *Assay-Oven*, used by the *Norimbergers*, *p.* 13. an *Assay-Oven* made of *Tiles*, *p.* 13. 235. an *Assay-Oven* made of *Potters-Loam*, *p.* 13. 235. an *Assay-Oven* made of *Armour Plates*; *p.* 13. 153. a *Granulating Kiln*, *p.* 56. an *Oven* to *burn Silver*, *p.* 80. a *Roasting Oven*, *p.* 112. the *By* or *Side Ovens*, *p.* 123. 161. 172. 177. 185. *Oven* for *Retorts*, *p.* 177. a *melting Oven* for *Copper Oars*, *p.* 248. and others. Now for your assistance in the more fully knowing of these *Furnaces*, you may read Dr. *Salmon's* 5th Book of the *New London Dispensatory*; which I have formerly cited, where from *p.* 821. to *p.* 828. he makes 17 several *Furnaces* for several uses, and each of them may also be varied, according to the *Ingenuity* of the *Artist*.

OUNCE. *See* Weights.

OUTLANDISH. T. *Eintrembbling-Auszleanger*, L. *Extranens*, *Aliegena*, *Exoticus*, which A. terms *Strangers*, *Aliens* or *Forraigners*; all intending those who are not of the same *Country*, and those the *Jews* called *Heathens*, and the *Greeks* (according to *Plautus*) *Barbarians*. *See* Metallick Countrys.

OX T. *Oches*, *Rind* and *Rund*. L. *Bos* and *Teriones*,

quasi

quasi terra terat (*Minshaw*) we call a *gelt Bull*, a *Steir* or *Runt*; but the *Germans* call a Bull ungelt, a *Steer*; and the Lat. have also a Distinct name, *Taurus*: and A. properly a *Bull*: so the *Ox* hath three names, *viz*. *Ox*, *Steer* and *Bullock*, and these are of the greatest size, and it is called *Bullock*, or more properly *Bullack*, because it lacks something which it should have: the lesser sort are called *Runts* (according to the *Teutonick* word) *viz*. *Welsh* or *Scotch Runts*, these and the *females* of this kind have several other names, as *Beeves*, *Cows*, *Neat*, &c. in which the *metallick* Art hath little to do, but with their *Blood*, *Bones*, *Dung* and *Tallow*, which are employed for several uses about Metals and their meat for the sustinance of the Artists. *See* Blood, Bones, Dung, Tallow.

OYL, T. *Oele*, L. *Oleum*, and *Linseed oyle*, T. *Lein-samen*, L. *Linarus*: Which is no other with us than the seed of *Flax*, which in other Languages is *Line* or *Linnen*: but for the *Oyl* of *Linseed* it is well known to all that do paint with *oyl*, that it hath this Quality, that though it be *liquid* like other *oyls*, yet is of a more drying nature than any other Oyl, and therefore the more fit for Metallick Lutings, *&c. lib*. 2. *cap*. 27. *sect*. 53.

P A P A

PAGAMENT. I retain the word, because I find that in *Florio's Italian* Dictionary, *Pagamento* signifies any kind of *Payment*, *l*. 1. *c*. 1. *s*. 1. which signify any *broken* pieces of *Coin'd Money*, which before made good

good *Payments*, and this word we abreviate from *Pagamento.*

PALE-COLOUR. T. *Bleich*, L. *Palidus*, and A. *Bleak*, *Bleek* or *pale*. See Colours, *l.* 2. *c.* 43. *f.* 1. and we have a word *Pale*, which the T. call *Pkall*, L. *Palus*, used for pieces of wood to *pale in* or *impale* a piece of Ground, or inclose it with *Wood*, as with a *Garment* (from *pallium* an outward *Garment*, which being decayed of its native *colour*, there usually grows *moss* on it, of a *pale colour.*

PAPER, T. *Pappyr*, L. *Papirus* (*l.* 2. *c.* 23. *f.* 3. of which *Pliny* saith, That all civility of this life, and the memorial and mortality also of Men after Death (by which he shews that he was not of the *Sadduces* opinion) consisteth in Paper, which saith he, was made of a Plant, having the name of *Papirus*, and he cites *Varro* to tell us, That the first *Invention* thereof was in the time of *Alexander* the great when he conquered *Ægypt*, and built *Alexandria*, where it was first made; and till then their *Memorials* ever were writ on *stone*, *lead* or *Brass*, &c. and, as I take it, *Josephus* tells us, that upon *Enochs* Pillar of stone, (which remaind to *Moses*'s time) were writ those things which were done before the Flood. Also the Ten Commands were writ upon Stone: but for more easy *Portage*, and transmitting the minds of men one to another, *Paper* was invented (as *Pliny* saith) in *Ægypt* from the *Bark* of a *Plant*, *lib.* 13. *c.* 11. and 12. where you may read the several names it had, the first and best sort called *Augusta*, the next *Livia*; &c. and many more sorts of it, and tells you also the manner of making it; and that, what they did not use of that Plant for Paper, was imploy'd for making little Boats, and the outward *Rind*, for many *uses*, especially for Ropes, which makes me think, that the *Withy tree* which grows plentifully in *Worstershire* (of which I have spoke in the word *Coal*) is of the same nature, for this Plant *Papirus* (as *Funcius* saith) was about ten *Cubits* high, and so is the *Withy*, and that *Papirus* grew about *Nilus*, and other waterish places, so doth *Withey*, and that they made ropes of it, and so they do of *Withy*: so that I conceive, the inward

Bark

Bark may make the like *Paper*, which may be tryed for experiment-ſake only;for our *Paper*(made of *Rags* by Water-Mills, call'd *Paper* Mills, of which I have ſeen many in *England*) is much better and more uſeful with leſs charge) however, the Knowledg of ſuch antient things are not to be loſt, and whatever *Pliny* ſaith of the *Antiquity* of it, the *Chiniſts* pretend to the uſe of *Paper* long before *Alexander*, as a Friend of mine (Cap. *J. Hall*) told me who had been thrice at *China*, and the laſt time brought me a fair Book, all written in their Language long before that Emperor,and that the leaves were only made of the *Bark* of a *Tree*, but of that he could give no certain Account.

To PEARCE, or *Pierce*, T. *Booren*, L. *Forare* (lib. 1. c. 34.) and we after the T. to *Bore*, probably alluding to the *Bore*, who, in rooting up the *Earth* with his *Snout*, doth as it were *bore* it, for the Lat. calls a *Bore*, *Aper*, becauſe he doth *aperire humum*, and ſo by *boring* it doth open a paſſage into *Metals* or other things.

PEEBLES. *See* Stones.

PELLICAN. T. L. A. and all from *Pellecanus* (Sculpture 29. *f.* 4.) the *Greek* word ſignifies *perforare*, or to *pierce through*; in alluſion to the Bird called a *Pelican*, which hath a bended *Bill*, by which, (as 'tis ſaid) when her young ones are poiſoned with eating Serpents,ſhe picks an hole in her *Breſt*, and gives her *Blood* to them, which cures them; and ſo this Inſtrument, doth as it were ſuck the *blood* or *ſpirits* out of ſeveral *Ingredients*(for ſo Blood is compoſed in *Bodies*)of which the *Aqua fortis* and *Aqua regis* are made, and by thoſe waters both *Gold* and *Silver* are cured of their poiſonous natures.

PENDULA, See *Sculpture* XI, theſe are of two ſorts, one hanging conſtantly in a perpendicular line, the other is in a conſtant motion,and of a late *Invention* for *Clocks* and *Watches*, and made of *Iron* or *Steel.*

PETREFACTION or *Petrification*, *T. Stein-Drehen*, *L. Petrificatio*, which is nothing elſe than a making that to be, which before was not, a *Stone*; and this effected by *Art* or

 Na-

Nature, thoſe which are done by *Art* are the *Counterfeits* of *Gems*, as *Rubies*, *Saphirs*, *Emeralds*, &c. and Counterfeits of Groſs *Stones*, as *Marble* and other common *Stones*: but I ſpeak of ſuch as are done by *Nature*, and thoſe of what I have ſeen, which I conceive are only performed by a *peculiar Water* ordained for that purpoſe, as at *Poolls-Hole* in *Darby-ſhire*, where are great grey *Stones*, like our *Free-Stones*, made by the cadency of Water, and ſome of thoſe ſtones alſo *cemented* by *Water*, ſo as there are two or three large Arches of thoſe ſtones *cemented* by *Water*, and where they were not perfectly joyned; by the light of Candles, I could ſee through one Arch to the uppermoſt, and ſo they lay promiſcuouſly in the Vault, as big as a little Church: the leſſer *Stones* are in the nature of *Icicles*, but not bright, and ſo encreaſed in hardneſs, length and dimenſion, according as the Water deſcends on them, ſo as at the points are drops of Water ſtill condenſing into Stone.

The next which I ſaw, was at *Oky-Hole*, near *Mindip*-Hills in *Sommerſetſhire*, where the nature of that conſtant dropping, petrefy'd it ſelf into a *Chriſtaline Form*, and ſo ſeem'd (by the light of Candles, of which I had ſtore) as ſo many *Chriſtal Icicles*.

After this, I had occaſion to Viſit Sir *Robert Coke*, at his Houſe called *Durdans*, in *Surry*, now belonging to the Honourable Earl of *Berkly*, where I found an Artificial *Groto*, made of *Flint Stones*, and looking up to the top, I perceived many little pendent Stones like Icicles, hanging on the *Arch-Flints*, and calling *Pool's* and *Okey* Holes to mind, I broke off ſome of them, and found them to be congealed *Stones*, and as the others were of a *Free-Stone* and *Chriſtaline* temper, theſe were *Flinty* drops of Water hanging at the ends, like the other almoſt congealed ſtones.

Theſe Obſervations I made of *Lapidinous* Waters, condenſing themſelves from the matter through which they paſs.

The next are of the like Waters penetrating other *ſubſtan-*

ces

ces, so *petrefying* them: and one of them is near *Knasborrough Castle* in *Yorkshire*, where there is a *Well* which turnes pieces of *Wood* and *Leaves* into *Stone*, and other things of a complying nature: But I had a *Honey-Comb* presented to me from thence, which was made perfect *Stone* by that *Well*, which I the more wonder at, because things of cerasious tempers, are usually *Resistables* to Water.

The other is that at *Deepham* in *Norfolk*, there is a *Tree* 13 yards about near the root, and at least 80 Foot high, which bears a flower very pleasing to the Ey, and Smell. Sir *Tho. Brown* Doctor of Physick, eminent for universal knowledg, call'd it while he lived, a *Teasle Tree*, and said, That he never saw but one of them, about the further part of *Germany*, and that many had try'd to *graft* or *inoculate* part of it, but without success. Now at the bottom of this Tree there is a Spring of the like nature, with that in *York-shire* for *Petrefaction*; now, I wish, that a *Graft* might be carryed from thence into *York-shire*, and planted near that *petrefying* Well, by which it might be seen whether the Tree gave any such Virtue to the *Spring*, or the *Spring* to the *Tree*: from which, and other *Inquiries* I have still been diverted by publick Imployments.

The last which I shall mention, is of Earth which hath a petrifying quality, and this I was only inform'd of by Mr. *Castle*, a known person both for Integrity and Estate, in one of whose *Mannors*, near *Cambridge* there is an Earth, where as he told me, He had taken up several pieces of Wood which were turned into perfect stone, and this is confirmed, in *Cambden's Brit.* p. 401. of a Ladder turn'd to *stone*, which, he saith, was taken out of the *Earth* at *Asply Gowish* (I suppose in the same Mannor) which was kept in the *Cistertian Monastery*, near *Asply*, as a great Rarity, and I have both read and heard of the like *Earth* in other places: But it is an *Error* to attribute this to the *Earth*, whenas it is only a *lapidinous* Water, which is in the Earth, and infuseth it self into such porous Bodys, and so makes it become *stone*, and that which confirms me herein,

is,

is, That near this, there is a Quarry of *stone*, or Earth and water turn'd to *stone*, but it is of that nature, as Mr. *Castle* inform'd me, That if it be digg'd by the Rule of the Compass, and mark'd *N.* for *North*, and *S.* for *South*, &c. and laid in any structure as it was digg'd from the *Quarry*, it proves a very durable *stone*, but if laid otherwise, it moulters to sand; which is of late years not only observ'd, in digging and placing other Stones (though more consolidated) but also in removing Plants, derived from Water and Earth.

Now I observe in the whole matter, That this Water that thus petrefies it self or other substances, is adapted with a *lapidinous* Nature, not only to condensate it self but such other substances as may imbibe that quality: so that it is not properly called, *cold* (as is commonly said) that turns water into *Icicles*, but a volatile *lapidinous* water, that flyes about, which as *cold* or *coldness* doth improve to *petrefaction*, so *Heat* or other *warmths* do hinder from condensation, and this petrefying *water* is of a *salt* and frigid *nature*, as we may see, that if *Snow* and *Salt* be put into *a silver*, *tin* or *pewter Pot*, and set on a *Board*, wherein fresh water is to be pour'd, and then move the *liquor* about in the *Pot* with a *Stick*, and in less than half an *hour* the water under the *Pot* will be congealed to an *Ice*, and so will glew or freeze the *Pot* and *Board* together, of which you may read more in *Berkley's Argenis*. So I shall referr the further Discourse of *Petrefying* to the word *Waters*.

PEWTER, T. *Speauter*, but the *Pewterer* or maker of it is called *Kanngiesser*, L. *Plumbus Cinereus* (*Holliock*) and *Argentanus* (*Minsh.*) but the *Italians* call it *Stagnaro*, from *Stannum*, *Tin*, for it is properly an Art derived from the *Stanniries* or *Tin Mines*; because the best *Pewter* is where all or the greatest part is *Tin*, yet they put with it sometimes *Silvery Lead*, but for want of that, a little *poor Lead*, or the *Ashes* or *Dross* of *Lead*, but when it is much *adulterated* with Lead, it is quickly *discerned* by the weightiness of it: but the

T. calls a *Pewter Dish, Dish Zienen schueshel,* which is a Dish made of *Tin. l.* 2. *c.* 20. *s.* 2.

PIBBLES, *T. Keisel-steine,* from *Kisel* a *Flint,* L. *Calculus à Calcando,* becauſe it may be kick't up and down; and as they are little of themſelves, ſo they are of little uſe about *Metalls,* otherwiſe then as they are beaten and mixt with *Metallick Flints, l.* 1. *c.* 4. *s.* 2.

PICTURES, T. *Bilden-Geinaild-a-maklen,* L. *Pictura* and *Imago*; the Makers of theſe are called *Picture-Drawers, Limners* and *Painters,* and theſe are of ſeveral ſorts, but the chief *Compoſition* of their *Colours* are from *Metalls*; eſpecially the *Effigies* on *Coyns,* which may be numbred amongſt *Picturas ſolidas,*and this *admirable Art* of *Picturing* is borrowed from *Nature*; ſo that in this *Age* the *Art* is come ſo near to the *Original,* that nothing but want of *Life,*ſeems to *diſtinguiſh* them. *l.* 2. *c.* 48. *s.* 2. See *Sculptures.*

PINCERS, T. *Zangs,* from thence we have our word *Tangs* or *Tongs,* that is, to hold faſt; L. *Forceps* and *Volſella,* theſe are of ſeveral *ſorts* and *ſizes,* according to the uſes; for common Fires they are called *Tongs,* for ſmall Works, *Plyers* and *Nippers*; but in Metallick Work, *Pincers* or *Tongs*: ſee Utenſills,and Sculpt. 11. *&c.*

PIPKIN, *T. ein Topfein,* from whence our word to *tope* or to *drink,* and the *Potters Clay,* of which theſe *Pots* are made, is called *Toepff,* L. *Ollula,* a *little Pot,* and theſe are uſed about Metalls. *see* Utenſils.

PITCH, *T.Pech* (according to *Minſhaw*) but *Erckern, Bech,* L. *Pix,* and ſo moſt of other Languages, writ with P. and this *Pitch* is a *Black Gum,* which comes from a Tree of that Name, but are of the ſort of *Pines* (whereof we have none in *England*) but have the *Gum* plentifully from other parts; the *white Pine* yieldeth a *white Gum,* the *Pitch* or *black Pine,* a *black Gum*; we have ſeveral uſes of this Word; *viz.* the *pitch* of an *Hill*; to *pitch* a *Bar*; to *pitch Tents*; and a *pitch't Battle*: and all are but *Alluſions* to the *glutinous* nature of this

Gum, used in *Luting* of *Metallick Vessels* : *l.* 4. *c.* 12. *s.* 2.

PLANCHES: see *Blanches*, both of them signifying *white pieces* of *Silvery Tin-Plates*, and sometimes for *Wedges* of *Gold* or *Silver*, or other *Metalls*, and from thence the word *Planks* are used, for *flat* or *plain pieces* of sawn *Wood*, thicker than *Boards* : *l.* 1. *c.* 1. *s.* 1. *See* Blanches.

PLATES of *Metal*, T. *Ein Blat ven Metal*, also *Blech*, L. *Lamina*, *l.* 4. *c.* 4. *s.* 4. or pieces of *Metal* made *flat* and *smooth*, and these are of *Iron*, *Tin*, *Brass*, *Copper*, and such as are of *Silver* or *Gold* (wrought in various shapes) as *Cups*, *Dishes*, &c. are still called PLATES.

PLASTER, *T. Gips* and *Tinchwerk*, L. *Gipsum* and *Emphlastrum*, this is a composition of *Quicklime*, made of *common Lime-stones*, but the best is of *Alabaster*, and this is used without any mixture of *Sand*, and is an excellent Fence against *Water* ; but *Pliny* tells of a natural *Plaster* in *Cyprus* ; but we have none such, and therefore do use *Alabaster* or *Talk*, both of which he mentions (*l.* 36. *c.* 24.) wherewith in those days they made *Fret Works* and *Images* ; but of later years they are grown to a great Perfection, by a *Past* of that *Plaster*, to *mould* and *fit* it to any part of *Man* or *Woman*, and so take the perfect *proportion* of that part, be it of *Face* or *Hand*, and when that is dryed, they put a like *past* into the *Mould*, so as by joyning of the part so *moulded*, the whole *Body* of a *Man* or other *Creature* may be *represented*, in a *pure white shape* ; which may be *coloured* as they please: These are graceful *Figures* (and may be seen at many *Stone-Cutters*, but very subject to break) yet much less than those of *Wax*, which *Art* is also come to great Perfection. *See* Utensils.

POLISH. *T. Polieren* and *Polirs*. L. *Polire*. *l.* 1. *c.* 34. *s.* 6. and this is done by rubbing *Metal* with *Puttee* (made of *calcin'd Tin*, or with other Stones (as the *Hemathite*, &c. see *Blood-Stone*) or other *smooth* and *hard Metals*, as *Steel*, *Iron*, &c. to make it render its *natural* or *artificial colour* more *beautiful* ; and it may have a just relation to *Policy*, by which *Art*, even

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Governments of *Kingdoms*, *States* or *Cities* are made *ſmooth* and *pleaſing* to the Judgments of Men. *See* Hemathite.

POTTERS-work, *and* Pots, T. *Toepffer*, *Zeug* or *Werck*; L. *Figulus*, and *Operator Figuli*, (*l.* 1. *l.* 2. *l.* 4.) that is a maker of Pots; which the *Jews* well knew when they wrought in that ART under *Pharaoh*, but whether they were *metallick Pots*, as *Crucibles*, *Teſts*, &c. it is not ſaid: and he that is a good *Aſſayer* as *Erckern* was, will ſee them made himſelf, and not truſt to the *Potter*. *see* Clay, Pots, Cruiſes, Jugs *and* Utenſils.

PRECIPITAION, T. *Nider Schlag*, (*l.* 1. *c.* 33. *ſ.* 3.) L. *Precipitatio*, or to *beat* or to *make that Nider*, or *Nethermoſt*, which was *uppermoſt*, and I do uſe the words often *to caſt down*, for ſo L. *precipitatio* ſignifies: Now how Metals are thus *caſt down* or *precipitated*, is ſeen in ſeveral parts of the four firſt Books: but the general way of *Metals* is firſt to *diſſolve* them in *Aqua fort.* or *Aqua Regis*, or *Spirit* of *Nitre*, or *Vitriol*, and then they may be *precipitated* with *Sea water* and *Alcalious Lixiviums*.

PROCESS, (*l.* 2. c. 45.) is no other than the proceeding in the *Metallick Art*, as it is in the proceeding of the *Civil Law*, till Judgment, &c.

PROOF, proving, *l.* 1. *l.* 5. *Vid. Aſſaying*, of little difference, for *Proving* is but an *Aſſaying*.

PULVERATION, and *Pulveriſing* (l. 1. c. 8. ſ. 4) ſignifies the *beating* of any *Oar*, Metals or other things to *duſt*, (ſomtimes called T. *Slaut.* L. *Pulvis*) or to *aſhes*. (T. *Aſchen.* L. *Cinis*,) or to *Pouder*; (T. *Pulvir*, L. *Pulvis*;) and theſe three are made by *natural* or *artificial* Fires or Heats (for *contunding* or *beating* things to *duſt*, *aſhes* or *pouder*, is but an artificial *motion* of *Heat* (for no motion is without *heat*:) and theſe *duſts*, *aſhes* or *pouders* are but the laſt Works of Nature upon all *Bodies*, for the next work is a *metaphyſical* reducing the *Aſhes* of all *Bodies* to a *Purity*; and as we ſee here the *duſt* of *Metals* and other things by *Calcination*, *Incineration* or *pulveration*,

veration, what admirable products are from them; so we may thereby be convinc'd that the *Omnipotent Chimist* of all Creatures will shew his *Divine ART*, in improving the *Dust* and *Ashes* of our *Bodies* into a greater *Purity* than what we in this World (or *terrestrial Mine*) can injoy: for here we are subject to all impure *Mixtures* till a *super-celestial* fire shall *purify us*, and who knows but that the *Spheers* of the seven Planets are the *Gradations* of those seven *Fires* which *David* speaks of, with which we must be seven times *refined*, before we can be admitted into St. *Paul's* third *Heaven* or the *Heaven* of *Heavens*: and I cannot here but call to mind the *Rapsody* of Dr. *Donne* (*Ser. vol.* 2.) speaking of the *Resurrection* of our *Dust*; saith thus, 'Where be all the *splinters* of your Bones which a '*shot* hath *shivered* & *scattered* in the *Air*? (or, of those *Bones* 'which the Metallick fires have consumed to *ashes*?) where be 'all the *Attoms* of the *Flesh* which a *Corrosive* hath eaten? or a '*Consumption* hath breathed, and exhal'd away from our Arms 'or other *Limbs*? in what *wrinkle*, in what *furrow*, in what '*bowel* of the *Earth*, lye all the *grains* of the *ashes* of a *Body* '*burnt* a *thousand years since*? in what *Corner*, in what *Ven*-'*tricle* of the *Sea*, lies all the *Jelley* of a *Body drownd* in the '*general Flood*? what *Coherence*, what *sympathy*, what *de*-'*pendence* maintains any *relation*, any *correspondence* between 'the *Arm* that was lost in *Europ*, and that *Legg* which was 'lost in *Africa* or *Asia* (score of years between)? One Hu-'mour of our *Bodies* produceth *Worms*, and those *Worms* suck 'and *exhaust* all other *humours*, and then all *dyes*, and all *dryes* 'and *moulders* into *dust*, and that *dust* is blown into the *River*, 'and that *pudled water* tumbled into the *Sea*, and that *ebbs* 'and *flows* with infinite *Revolutions*, and still, yea still *God* doth 'know in what Cabinet every *seed pearl* lies; in what 'part of the *World* every *grain* and *particle* of every *mans* '*dust* doth *lye*.

Now we are to believe, that this *scattered Dust* over all the *Elements* shall (in the twinkling of an eye) have a glorious *Re*-

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ſurrection, far more glorious than what is producible by *Metallick Art*, which ſerves here but as an Illuſtration of what may be expected hereafter; but to return to our *Chymical Duſt*, *Aſhes* and *Pouder*, the *duſt* of *Diamonds* is moſt remarkable, becauſe nothing can *maſter*, *cut*, or *poliſh* a *Diamond*, but by its own *duſt*; and it is a *delicate Art*, eſpecially their *Mills*, by which with the *duſt* of it they make ſo many curious *Angles*, as that they are all reflectionary glitterings, and ſparkling *Lights* to each other.

Then for *Aſhes*, the ſeveral *Lixiviums* or *Lees* which are made of the ſeveral ſorts of them, they are of great uſe in *Chimiſtry*, eſpecially thoſe that are made for *Salt-petre*, without which ſcarce any *Metallick Operation* can have good effects.

And for *Pouder*, the moſt eminent is, that which is made for *Guns*, viz. (of *Salt-petre*, *Charcoal* and *Brimſtone*, and ſome other *ingredients* to heighten their *tempers*,) and when it is perfected for the uſe, it doth as it were revenge its own *Contuſions*, by ſhattering the pieces of others almoſt into *Atoms*, and therefore called T. *Buechſen-pulver*, L. *Pulvis tormentarius*, as if it had been invented by the Friar, to *torment others before their time*.

Now ſeeing I am writing of *Gun-pouder*, I have long ſince conſidered of the vaſt quantity that is ſpent in *ſalutes*, &c. and it was my chance to meet with an Ingredient of a cheap rate, with which, ſuppoſing a pound of *pouder* to be uſed, I took a 4th. part of it, and three parts of my Ingredient, (which was not of the charge of a 4th. part of *Pouder*,) and with that mixture did make a Report rather greater than leſs than the whole pound of *pouder* would have done; but this compounded *pouder* is more for *noiſe* than *execution*, which is the chief uſe of *Salutes*, or for Triumphs, whereby half 3 parts of 4, in the charge of common *Gun-pouder* may be ſaved.

And ſeeing I have told you of a *pouder* of *Salutation*, give me leave to tell you, That I have found out a *pouder* of *preſer-*

vation, ſuch as without *Salt* ſhall keep Meat in its Blood and Gravy, *untainted* or *unputrified* for more than a year: of which ſome little experiment I have made, but not ſufficient to ſatisfy my ſelf.

There is yet another *Powder* which I am to ſpeak of, *viz.* a Powder of *Dulcification*, which is a peculiar *Art*, but for that I ſhall conclude with *Herbet*, that Divine Poet, as an admonition for the good uſe it,

> *When* Hair *ſmells ſweet through* Pride *or* Luſt,
> *The* Powder *hath forgot the* Duſt.

PURIFICATION, *purifying*, T. *Rein*, *Reinigen*, *Saeuberung*, L. *Mundatio*, *Purgatio*, *Purificare*, *Clarificare*, *Defæcare*, to ſeparate *Metals* from droſs, either by waſhing, by clarifying, filtring, digeſtion, or diſtilling; and this is done by water only, or by fire only, and ſomtimes by both joyntly : See *Cleanſing*, *Purging*, *Clarifying*.

PUTRIFACTION, T. *Verrottung* & *Verfalung*, L. *Putrifactio*. A. *Rottenneſs*, *Corruption*, *Putrefaction*, &c. as *Bees* from a *Lions Carcaſs* (Judg. 14. 8.) *Snakes* from the *Corruption* of *Horſe-hair*, *Magots* and *Flies* from *corrupt Fleſh*, *Eels* from *corrupted Dews*: and in all *Hiſtories* of *Nilus* it is ſaid, That the *Mud* thereof breeds (beſides other larger Creatures) an infinite number of *Mice*, in which Experiment, we need go no further than the *Iſland* of *Foulneſs*, in *Dengy* hundred, in *Eſſex*; where, as my Author Mr. *Bernard* (a very credible Gentleman) affirm'd to me, and it is confirm'd by *Chiſwell* in his *Britania Baconica*, that about the end of every year, in his ground there, a prodigious number of *Mice*, were bred from the *Soil* of his *Grounds*, ſo as he had often ſeen ſome of them not fully ſhap'd, and theſe *Mice* about *Auguſt*, did devour all the roots of the *graſs*, whereby the *graſs* being withered, the whole ground ſeemed like a *bed* of *chaff*, wherein the *Mice* delighted themſelves; but whilſt they were in their *ſports*, about

about the end of every *September* there came a ſort of little *Owls* (in great numbers, but much leſs than thoſe which are bred in *England*,) and ſo being *fill'd* and *fatned* they flew away again, and what with the *chaff* and *carrion* of the *Mice*, and *dung* of the *Owls*, the next *Spring* the grounds produced again plenty of *Graſs*, which *fatned* him yearly many good *Oxen* : Now this *putrefaction* is not only ſeen by producing ſuch Inſects, but in *Metals*, for the *Ruſts* of them are but *rots* or *putrefactions*, as when *Ceruſe* is produced of *Lead* made rotten with *Urine* or *Vinegar* ; and *Verdigriſe* produced from *Copper* made *rotten* by fumes of *Wine*, and many ſuch like *putrefactions*. See Pulveration, *&c.*

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QUARRY, *T. Steinegruben* (which word *Grub* is uſed in *Engliſh* to *ſearch* for *Stone*, &c.) L. *Lapidicinia*, *Latonia*, *Latumia*, *Lithomia*, and *Fodina*; and for a *Quarry* of *Mill-ſtones*, *Cotaria*.

It is not agreed from whence this word is derived, but the *French* comes neareſt to the matter, *viz.* *Querir*, from the *Latine Quærere* to ſeek (or *pro qua re quærit* ; and ſo an Hawk is ſaid to have her *Quarry*, when ſhe hath got what ſhe flew at; however it is called alſo *fodina*, which is the title to a *Mine*, and indeed the *Mines* for *Metals*, *Minerals* and *Stones*, are ſo near of *kin* that they may all be called properly *Fodinæ*, See Mines, Minerals, Stones, Waters.

QUENCH (or to *Quench*) T. *Ermorden*, that is, to put to Death, alſo *Andeſchen*, L. *extinguere*, which (in *Metals*)

is

is, when the heat of them are taken away by *cold water*, ſo *quenching thirſt* is the allaying of *heat* in the *body* by ſome *cooling liquids*: and it may alſo come from the *Quince* Apple, which hath the quality to allay *flames*, *thirſtineſs*, &c. coming from hot cauſes.

QUICKSILVER, T. *Queckſilver*, L. *Argentum vivum*, *Argentum liquidum*, & *fuſile*, & *Hidrargirum*, or *Argenteum aqueum*, and this by *Chimiſts* is devoted to the Planet *Mercury*, and ſo by them alſo called *Mercury*, for its *Agility*; and therefore the *Heathens* (who worſhip'd it as a *God*, yet) put an humane ſhape on it, with Wings to his Feet.

But our *Metallick Mercury* or *Quickſilver* is of two *Sorts*, viz. *Adulterated*, and *Natural*; as for the *Adulterated*, it is eaſily diſcovered, by putting ſome of it into a *Spoon*, and ſo over fire let it *evaporate*, and if it leaves a *black*, or *duskiſhneſs*, 'tis falſe, but, if *white* or *yellow*, 'tis good. As for the *Natural* (as I ſaid in the word *Metal*) we have very little or none in our *Mines*, ſo that we do fetch it from our *Neighbours* out of *Hungary*, *Spain* or *America*, &c.

Many have written largely of the Nature of it, and therefore I ſhall only tell you, It is ſeldom found in the Earth with any of the beforenamed *Metals*, but delights it ſelf in the *Cinnabar*, *Vermilion*, or *Minium* Stone (of a Metallick nature, (much us'd by Painters and Dyers) and there naturally is encloſed; and Mr. *Nicolls* (in his deſcription of *America*) tells us, That in the *Vermilion Mines* at *Palcas*, it yields to the King of *Spain* every year 8 or 9000 *Quintals* (which is ſo many 125 *l.* weight of *Quick-ſilver*) and that of later years they refine more *Metals* by *Quick-ſilver* than by Fire, in which operation it hath this peculiar vertue, that it ſeparates and conſumes all of them but *Gold* and *Silver*, and though it will not ly in one Bed with them in the Earth, yet when they are made Play-fellows, or fellow-Labourers (for the uſe of man,) it doth moſt naturally ſympathize with *Gold*, and divides and ſeparates it from all other *Metals*, with which it is at any time intermixt: circling it about

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without any other intermixture but it ſelf; but it doth not ſo intimately and perfectly *unite* it ſelf with *Silver*, for it doth not pierce it, but conſumes the courſer Metals from it, if there be any mixture; and though it be the heavieſt of all Metals, yet if any Fire offer to meddle with it, it evaporates it ſelf into the lighteſt ſubſtance, *ſmoak*, to ſome colder Region, (as its refuge or ſhelter,) where it again embodies it ſelf, and becomes as perfect as at firſt, by aſſuming again its *natural colour, white*; and 'tis obſervable, That though it lies in a Bed of pure *Vermilion*, (which gives a glorious *red colour* to all things whereever 'tis uſed;) and though it is uſed, and in a manner *incorporated* with *Metals* and other things of various *colours* and *natures*, yet this noble *active creature* ſtill retains its *whiteneſs, purity* and *efficacy.*

For though by the ſtrength of *Art* (as *Paracelſus* tells us,) it is ſometimes forc't to aſſume a *yellow colour*, (to ſhew its affection to *Gold*) and ſometimes to a *pure red* (to ſhew its native kindneſs to *Cinnabar*, yet theſe are rather *aſſum'd* and *aſſimulated colours* (in reſpect to other *ingredients* and *compoſitions* with it,) than any real change of its own *whiteneſs*, and ſo for its *Medicinal* uſes, it is ſometimes called *Mercurius dulcis*, *Mercurius vitæ*, *Mercurius ſublimatus*, and *Mercurius præcipitatus*, yet in all theſe diſpoſitions of it, it ſtill reverts to it ſelf, (eſpecially by the aſſiſtance of *Fire*, to make it *Volatile*) that it may be the better *fixt* in its original *purity.*

Now theſe obſervations cannot but raiſe my Thoughts, to make them applicable to the great *Miſtery* of *Reſurrection*; wherein I conſider, That as the *Galleniſts* are, or may be confirmed in the verity of it, by St. *Paul's* Argument to the *Corinthians*, 1 Cor. 15. 35, &c. So the *Chimiſts* may be alſo confirmed in the ſame by their *Chimical practice*, for they ſee that *Mercury* doth by *heat* ſo evaporate, that nothing of it is diſcernible to the eye; yet that *evaporation* being ſtopt in its *career*, by the top of the *Limbeck*, it there fixeth again in its *form, colour*, and indeed in all its *qualities, properties*, and *perfections.*

 Now

Now it is an undoubted Principle, both with the *Gallenifts* (who follow St. *Paul*,) and the *Chimifts* (followers of *Mofes*,) That all *Terreftrial Bodies* confift of *Salt*, *Sulphur* and *Mercury*, (which laft is the chief) fo as our *humane bodies* being of a more *Mercurial* temper than other *bodies*, may *experimentally*, and therefore *rationally* believe, That all the *Atomes* of our bodies being incited to it, by an *internal heat*, do like *Mercury* afcend to fome other *limiting Sphere* or *Orb*, and there ftays, till GOD (the Worlds great Chimift) thinks fit to difpofe of them at the *general Refurrection*, or *particular* (as he thinks fit.)

Now, where this *Sphere* or *Orb* is, (which fome call *Heaven* and *Paradice*, others *Limbus Patrum*, and *Limbus Infantium*; and others have another place, called *Hell*, and *Limbus inferiorum*, (as it were *Antipodial* to the other:) I fhall venture to give my guefs, and poffibly with as little fatisfaction to the World, as others have done in theirs: and that which guids me to mine, is this confideration, That the name for *Quick-filver* is *Mercury*, and that that Name *Mercury* is alfo fixt to the *Planet* of that Name (next above the Moon, whereby I apprehend that the *Chaldeans* and *Egyptians* (who are faid to be the firft Authors of the *Aftrological Characters* of the 7 *Planets*) did make both the *Planet Mercury*, and the *Metal Mercury* to bear one and the fame figure, thus [☿] well knowing more of the *fympathies* and *concurring operations* of the *Celeftial* and *Terreftrial Mercuries* than is yet communicated to us; but the *Hebrews* (before them) made feven of their *Letters* to fignify the feven *Planets* and feven *Metals*, and thereby the *figure* of *Mercury* (before it was altered by the *Egyptians*, was in this form [בּ] and fometimes thus [כּ:] And the *Jewifh Rabbins* did hold, that thofe two *Letters* did contain great Myfteries, (not yet alfo unfolded to us,) and therefore I hope it is no offence to conceive, That the *Sphere* of *Mercury* is the *Paradice* or *Receptacle* of all the *Mercurial fpirituous Forms*, of which our bodies do confift, and when they are *evaporated*

from

from hence they (by *an invisible ascention*) are *received* and *remain* in that *Paradice* or *repository*, so that the *Globe* of earth being 21600 *German* Miles in circumference (accounting 6400 foot to a *German* mile) and the *Diameter* 7200 Miles, and the *Planet Mercury* in the lower part of its *Sphere* (next the Moon, being 10255773 *German* Miles, and the upper part of that *Sphere* next to *Venus*, being 22855511 *German* miles, then the space of the *Sphere* of *Mercury* (considered Diametrically) between the lower part of the *Sphere* of *Venus*, and the upper part of the *Sphere* of *Luna* is 11599738 *German miles*, which great space may easily contain all the *Mercurial forms* which can possibly arise from the content in the small circumference of the *Terrestrial Globe*, and allow also sufficient room for the body of that *Planet*, (being as 'tis said, but 442 miles in *Diameter*,) so that it hath a space of 62999698 *German* miles above, and as much under its own *Globe*, in which it may move and actuate.

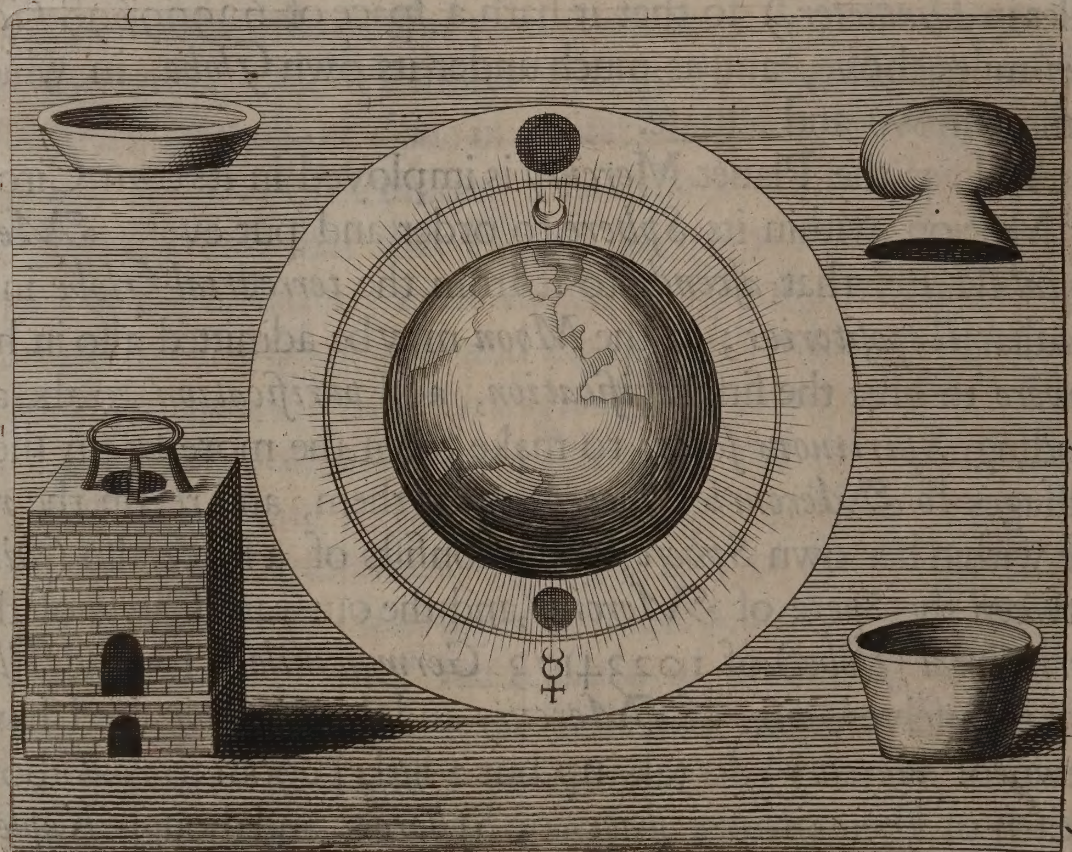
And, as the Planet *Mercury* is imployed in its own Circular Motion, within its *Sphere* to order and put every *Mercurial Matter* that *ascends* to it from the *terrestrial Globe* into peculiar *Repositories*; so the *Moon* may be admitted also in her *Sphere* to give the first *rarification*, and *purification*, to the ascending *Spirituous forms* to make them the more fit in their Passages *to Mercuries Reception* of them, and retain the *refuse* within her own *Sphere*, which consists of a space also (*viz.* between the *Spere* of *Mercury*, and the outward Circle of the *Terrestrial Globe*) of 10234173 *German miles*, for the *Planets* themselves, *viz.* of *Mercury* and the *Moon* (as I have shewn of *Mercury*) do take up but a little Room to *roul* about in each of their proper *spaces* or *Spheres*, and though *Kepler*, and others of late do not agree in their Computation about the *dimentions* of these two (and the other *Spheres*) yet these which I have set down (being generally so computed) may well serve as an instance, that so great *spaces* were made for some such uses as I have exprest: so that by the active *Operations* of the

Bodies

Bodies of theſe two *Planets* (*Luna* being but as a Servant or *vehicular* to *Mercury*) the *Mercurius Dulcis* and *Mercurius Vitæ* of all *humane Bodies* may be ſublimated into that *celeſtial Paradice*, and the *Caput mortuum* or *Mercurius præcipitatus* thrown down into a *Limbus*, either in the ſpace of the *Moon* (at preſent) or to the *Abyſs* of the *ſpace* of the *Earth*, when it ſhall (by the laſt *conflagration*) be *evaporated* or *annihilated* into a kind of *Vacuity* for that purpoſe.

But having ſpoken ſomething more of my Conjecture in my *Volatiles* on *Adam* and *Eve* (under the Diſcourſe of *Reſurrection*) I muſt refer you to it; and ſhall only add this following *Sculpture* for Demonſtration.

Sculpture XLIII.



RA RA

RATTER, *l.* 2. *c.* 2. T. *Raeder*, I find no Latine word of kin to the ſenſe of what *Erckern* intends by it, *viz.* a *riddle*, *ſcreen*, or *ſieve*, that is an Inſtrument to ſeparate the clean from the unclean *Oars*, before they come to the fire, and ſo may be called *magnum Cribrum*, or a great *ſieve*; yet it may come from *Rotatilis*, that is, moving ſwiftly like a Wheel, or *Rota*, ſhewing the proportion of Metals, or of any thing elſe; *Riddle*, which in the T. is *Ratzall*; that is, that the Queſtion being what part of the *Oar* is clean, and what unclean, this *inſtrument* doth *unriddle* it by ſeparation: and for the word *ſcreen*, it is doubtleſs from *ſecernere*, to divide, and *ſieve* from *ſegregare* or *ſevere*, to know truly the quality of the thing by ſeparation; There are other Words to the ſame effect, as *ſeirce*, *boulter*, not worth the trouble of examining their Original, but by *Ratter* is to be underſtood the great *ſeive*, and the other the leſſer *ſeives*. *See* Sieves.

RAW (*l.* 2. *c.* 3. *ſ.* 4.) T. *Rohe* and *Rode*, alſo *ungeſotten* and *ungekockt*. L. *Crudus* and *Atrox*, A. *Raw*, which is ſome old *Britiſh* word, ſignifying not concocted, and ſo applied to *Metals* before they are brought to the *fire* to be *boyl'd or roaſted*. *See* Roaſted.

REEDS, *l.* 5. *c.* 4. *ſ.* 3. T. *Rohz*. L. *Canna* and *Arundo*. *See* Utenſils.

RECIPIENT or *Receiver*, *l.* 2. *c.* 20. *ſ.* 6. T. *Emphaben*, L. *Recipere*, ſignifying *Glaſſes*, *Pots*, or *Veſſels* which are made

to run or hold *Metals* made *liquid*, or what is drawn from them by fire, or otherwiſe.

REFINING ſignifies no more than when *Metals* are *melted* and *fined*; yet to make them better, they do refine them, that is, melt them *again* and *again*, till they be clearly *cleanſed*, *purified* and *purged* from the *unclean metal* or *matter*, cleaving to the more *pure*.

REGISTER, T.L. A. *Regiſter*, and it ſignifies with us a *Memorial* or *Record*, ſo the Word is applied to the *Records* in ſeveral *Courts* of the *Common* and *Civil Law*; and theſe are very ancient (as appears by Sir *Thomas Smith*, de republica) but in the *Metallick* Art it is uſed for *Pluggs* or *Stopples* to be put in or taken out of little *holes* made in *Furnaces* or *Ovens* (called *wind-holes* and *air-holes*,) whereby the *fire* may be better *governed*, by giving heats or cools to the *Metals*, according to the *diſcretion* of the *Chimiſt*.

REGULUS, *l.* 2. *c.* 35. *&c.* L. A. *Regulus* (which ſignifies *a ſmall King*,) but *Erckern* in all places (where he hath occaſion to mention it,) doth make uſe only of the word *Koenig* (or King, and not *Regulus*,) from *konnon*, ſignifying *knowledg*, *power* and *ability* to *Govern*; and the Old *Saxons* called him *konning* and *cunning*, which we tranſlate *ſubtile*, (yet not as the vulgar interpret it *crafty*,) but one that is *Learned*, and *judicially polite* in his *Government*; now though *Metals*, (by ſome) are put among *inanimates*; yet others believe that they have a *vegetable Soul*, which is improved to an higher Soul by Obedience to its *king*; for it is agreed by *Chimiſts*, That this *king* doth give ſuch a *ſoul* and *temper* to *Metals*, that thereby they prove beneficial to the *World*, and gain an *eſteem* to themſelves, both for their *Origination* to *Wealth* and to *medicines*, *colours*, *ſounds*, &c. and all theſe they obtain by *obedience* to their *king*: and this puts me in mind of our *Alphabetical Letters* (which I think is included in the *Taliſmanical ſcience*) whereof God himſelf ſaith, That he is the *Alpha* and *Supream King* of them, (as of all *mankind*, and other creatures:) ſo that

if

if we consider them in their *virtual effects*, then such men as are Learned in them, and do pay their *obedience* by *Devout Vows* and *Promises* to him, may be called *Vowels*; such as act and do his Will at *Land*, may be called *Consonants*, such as admire him for the Wonders they see at *Sea*, may be called *Liquids*; and those that sit still in their *passive Obedience* (not grumbling or mutining) may be called *Mutes*, and these are the *Grammatical* methods of *Letters* and mens Obedience; now from the *consonants*, *liquids* and *mutes*, with the conjunction of *Vowels* (like *Magistrates*) they are formed into *Words*; and therein also God the Son will be owned as the chief of *Words*; and when they come to a *Talismanical Operation*, they may be ascrib'd to the *Holy Ghost*: In short, though the Letters seem to have no visible vertue in them, yet this is evident, that by submitting themselves (or men like *God-fathers* doing it for them) to that *order* which the great *Alpha* hath thought fit, *mysteriously* to direct, they are formed into *syllabical words*, *sentences* and *discourses*, whereby *God*, *Angels*, and *Men* seem to have a mutual *correspondency*; but when there is no obedience to that *order*, there is nothing but *misconstructions*, *non-sense* and *irregularities*, pernitious to themselves and others; And it is not only thus in *Metals* and *Letters*, which (though accounted *inanimate*, as I said, yet are or will be forced to be *obedient* and *regulated* by a *King*: but in sensitives, the *Bees* have a *King*, and by their *obedience* to him, they enjoy the fruits of their *Labours*, and take pleasure in returning each to its own *Cell*, or *House*, which is guarded with *Waxen walls*, and filled with *Honey* sufficient for its own food, and an overplus to supply others, and this proceeds from the happy product of Obedience, whilst the *stubborn*, *refractory*, or *lazy Droans* are thrown out of their *Hives*, *Houses*, and *Homes*, which they might otherwise have enjoyed, if they had not been *disobedient*; I might instance more, but it is enough for me that I have shewn the advantages which *Metals* have by their Obedience to their *King* or *Regulus*.

RE.

RETORTS, *See* Utenſils.

ROASTING of *Oars* or *Metals*, *l.* 1. *c.* 10. T. *Groeſten Roeſten*, A. *Roſt* a *Rore uſta*, or the burning away the *Dew* or moiſture of Metals.

RUBRIFIED, *l.* 2. *c.*44. *ſ.* 2. T. *Faſt rotten*, L. *Rubrificatus*, and I ſuppoſe the *Red Sea* is called *Mare Rubrum*, from ſome *red Mineral* under it.

RUSSET *cloath*, T. *Unbercite*, L. *Pannus fuſci coloris*, A. *Ruſſet* cloath, which is *Brown* or between a *white* and *black* colour; it may come from *Ruſticus*, becauſe Country-men ſeldom uſe *dyed* or *undreſt* cloath, but only the natural colour of *Sheeps* Wooll, when it is neither *black* nor *white*, but as a mix'd colour; however this is recommended by *Erckern* for retaining of the *Gritts* or *Sands* of *Gold*, ſo as they may not ſuddenly be waſh't away with other *Rubbiſh*.

S A S S A

SALT, *l.*1. *l.*2. *l.* 3. *l.* 4. and *l.* 5. T. *Saltz*, L. *Sal*, which may come from *ſalus*, *Health*, according to the Verſe, *Non ſapit eſca probe, quæ datur abſque ſale*: for indeed it gives not only to *Humane bodies*, but to *Metals* a *vivacity* and *ſanitude*; *Minſhaw* deduceth it from *ſalire*, becauſe it *ſparkles* and *leaps* in the *fire*: Now of *Salts* there are ſeveral *ſorts*, (as may be read in *Pliny*, *lib.* 31. *cap.* 7. to the 11. and in other places and Authors) but moſt *Chimiſts* do agree, that there are ſeven ſeveral ſorts, which are influenc't from the ſeven *Planets*, to attend the ſeven *Metals*; and theſe *Erckern* accordingly makes uſe of, viz. *Sal alkali* (or *ſandiver*, or *Salt* of *Glaſs*,) *Sal Armoniaci*, *Sal*

Sal Nitri, *Sal Vitrioli*, *Sal Petre*, (and common *Salt*,) *Sal Tartar* (or *Argol*, of which I have ſpoken,)and alſo *Sal Gem*, (which is the ſeventh *Metallick Salt*,) and is produced from a *Rocky Chriſtalline ſtone*,and of theſe he ſpeaks,and of no more, it being a ſubject of great extent, for I conceive there may be as many ſorts of *Salts*, extracted, as there are *Terreſtrial Creatures*,for all things do *conſiſt* of *Salt*, *Sulphur* and *Mercury* (as I have ſaid) but that which I aimed at, was to give an account of our *natural ſalts*, from *Springs* in *Cheſhire* and *Worceſterſhire*, and from the Lands on the South ſides of *Devonſhire* and *Cornwal*, which are full of *Salts*; for with thoſe Sands, ſo mixt, they *manure* their Lands to a great profit, and of which moſt other *Coaſts* of *England* are wanting, and have only the *Sea-water* to make their *Common-Salt*,but I cannot enlarge my obſervations upon any more words, becauſe the *Printer* calls for what I did write of a *Metallick Dictionary*,after I firſt propoſed the Printing of *Erckern*, but intending within the compaſs of a year to publiſh *Georgius Agricola*,*de re Metallica* (being fully tranſlated,) in *Engliſh*, and alſo to add a *Dictionary* to it,I ſhall reſerve my remaining *Eſſays*(if what I have done hitherto, be *approved*)till then, and ſo I proceed in the *Dictionary*.

SANDS, *l*. 1. 6, 29, *&c*. T.and A. *Sand*, and ſo the *Belgick*, but the *Italian*, the *Spaniſh* and *Latine* call it *Arena*, and the *French*, *Sables*, (which in *Heraldry* ſignifies *black*,) alſo it is the name of the *Furr* of a little Beaſt, called *ſabellus*, and *muſtulus*, *ſarmaticus*, of a *ſandy colour*. However *ſand* is of various uſes in *Metallicks* (as *ſand-Ovens*,&c.)and conſiſt of great varieties in *England*, which may admit of curious ſpeculations. *See* Earth, Gold, Mortar, Ovens, Petrification, Stones, Water.

SANDIVER, *l*. 2. *c*. 5. *ſ*. 1. *&c*. is the ſame with *ſal Alkali*, which *Pliny*, (*l*. 31. *c*. 7.) calls the *Tragaſean ſalt*, and is the ſame with *ſal Vitri*,or *ſalt of Glaſs*.

SCALES, are of a Ballance for weighing Metals, whereof you will find two ſorts in *Erckern*, viz. Proof *ſcales*, *l*. 1. *c*. 34.

s.12. and *inset scales*, *l*.1. *c*.35. *s*.2. T. *Tung*, *schuell*, L. *Lanx*, alſo for *ſcales* which come from *Metals*, T. *ſchuepen*, being the ſame word which they uſe for the *ſcales of Fiſh*, ſignifying the *ſcurf* or *flaky* matter taken off from *Metals*, ſometimes by *filing*, but chiefly by *fires*, *l*.2. *c*.26. *ſ*.2. and *c*.36. *ſ*.2. *See* Fleaky *and* Flaky, Shivery, *&c.*

SKIM or *skum*, *l*.2. *c*. 47. *ſ*.2. and *l*.5. T. *ſchaum*, L. *ſpuma*, A. *froth*; but in *Metals* it is, when they firſt riſe into a droſſy matter, yet not ſo thick as *droſs* till it is more condenſed; but in other things it hath only the name of *Froth*, fit to be *skimm'd* or *skumm'd* off: *See* Droſs. Scorias, Yeaſt.

SCORIAS, *l*.2. *c*.35. *ſ*.2, &c. T. *Truſer*, L. *ſcoria*, A. *droſſy*. *See* Droſs, Skim.

SEARCE, to *ſearce*, T. *ſalter*, L. *cribrare*, A. to *ſearce*, *ſerce* or *ſarce* (*Skinner*,) which is to expreſs the operation of a *ſeeve*. *See* Seeve.

SEEVE, T. *ſib* and *ſieb*, L. *cribrum*, A. *ſeive*, *ſeeve*, or *ſive* (Skinner.) *See* Ratter.

SEPARATION, T. *Abſouderen* (from *ſouderin*, to *ſoder* or to *joyn*, and ſo *abſouderen*, to *disjoyn*,) L. *ſeparatio*, A. *ſeparation*, and in the *infinitive* of *ſeparo*, it is *ſeparare*, or *ſegregare*, from whence the T. call a *ſeparating Oven*, a *ſagar Offen*, *l*. 3. *c*.15. and ſo *ſagar worke*, which is a *diſtinguiſhing* or *dividing mixt Metals* from each other, or other *matters*, adherent to the *Metals*. *See* Quickſilver.

SHIVERY, or to *ſhiver*, *l*. 1. *c*.34. *ſ*.3. T. *ſchivern* or *ſchiffern*, L. *diſrumpere*, when *Metal* is looſe, and eaſy to break into pieces; and ſometimes *light Oar* is called *ſhiffer Oar*.

SILVER, T. *ſilber*, from the *Greek ſilbo*, (*Minſhaw*,) A. *ſilver*; now as to the inlarging the *Etimology* of this word, uſed by the T. and *Old Saxons*, and ſo continued here; I muſt refer it to another time: only I obſerve that the *French* and *Italian* do comply to the *Latine* word *Argentum*; but the *Spaniard* calls it *Plata*, probably from the chief *City* and *Province* of that name, in *America*; or from the great *River Plata*, which

which runs 2000 miles through the *American* Mines, before it unloads its Wealth to the *Spanish Navy* (termed his *Plate-Fleet*) which supplies himself and his *Neighbours* with its *Treasures* of *Silver*, *Gold*, &c. I might also add many things about the *fining* and *refining* of their *Silver*, before it comes unto that *Fleet*, but I refer that to *Erckern's* four first Books; and *N. N's* Survey of *America*: for I know not the *Author*, but I find it ingeniously writ. *See* Metals, Mines, &c.

SLACK; *slack stones*, and *Slicks*, T. *schlack* and *schlick*; (often mentioned by *Erckern*, *l.* 1, 2, 3 and 4.) L. *Laxus*, and all signifying the loose parts of *Oars*, or the *Oars* made into *Metals*; yet still do remain *slack* and *shivery* in some part, and sometimes is taken for *Dross*, and that *Dross calcin'd* goes for *Calx*; or *slack'd Metal*: *See* Calx, Calcine, Lime, Dross, Flakes.

SMELTING, *l.* 4. *c.* 14. *l.* 4. *c.* 1. &c. *See* Assaying.

SOPE, T. *seiffe*. L. *Sapo* and *smegma*; *Pliny*, *l.* 28. *c.* 12. gives an account of its *Vertues*, and how it is made, but I question whether that be the *Venetian sope*, mentioned by *Erkern*, *l.* 2. *c.* 47. *s.* 2, &c. or the *Tin-sope*, *l.* 4. *c.* 13. or the *Gold sope*, l. 5. c. 10. s. 8. of which I shall discourse at another time.

SPAN. T. *Spann*. L. *Spithma*. *See* Measures.

SPAR. *l.* 3. *c.* 27. *s.* 6. T. *Sparstein*, *a white stony Matter*, that usually embraceth the *Oars* of *Lead* and *Silver*, called, L. *Fluor*; the word is also applyed to long pieces of *Timber* which serve for the *Roofs* of *Houses*, call'd *sparrs*.

SPARKLE, vulgarly *spartling* Oars, T. *Fuencklen-erkz*; L. *scintillare*.

SPELTER, *T.* is the name of a course *Oar* containing little *silver*, l. 1. c. 2. s. 11, and 15. of which there is a better sort of *Oar* called *Bismuth* or *Wismet*, *viz.* when it runs bright and well in the *fire*. *See* Wismet.

SPIZE, or T. *Speizy-Erks*, or gross *thick Oars*, reckoned among *course* or *unclean Oars*, and in *Erckern* (*l.* 1. *c.* 2. *sect.* 11.) fully described *cap.* 16. for the melting of which,

which, particular *Ovens* are made, *See* Ovens.

SPUNGE, *l.* 2. *c.* 4. *f.* 1. T. *Schwam*, L. *Spongia*, but how it is *produced* from, and used for *metals*, deserves a longer *Discourse*.

STEEL, *l.* 4. *c.* 20. and 27. T. *Stabel*, & *Stabel steine*, L. *Chalybs*, now this and all other sorts of *Iron*, are by *Pliny* (l. 34. c. 14.) comprehended under the word *strictura*, and he farther saith, That the goodness of *Steel* ariseth from the goodness of the *Iron*-Mine, from whence it comes, with the assistance of *Waters*, and *various Quenchings* of it in *Waters* or *Oyls*, to which he adds, That 'tis wonderful that *Man's Blood* should have such Virtue in it as to be reveng'd on the *Iron-blade* that shed it, for being once *imbrewed* therein, it is given ever after to *rust*, and *canker*. *See* Iron.

STONE. T. *Steine*. L. *Lapis* and *Petra*, which hath *hanc Petram* in the Accusative Case, for making such work in the World, by its *affinity* to *hunc Petrum* : But not medling with those Disputes, I might very well have inlarged my self upon this *Subject* of *Stones*, especially of those which *English Quarries* do produce, but I must also defer it.

SUBLIMATION, *l.* 1. *c.* 28. L. *Sublimatio*, which is a *separation* of *thin* and *fine Bodies* from their *grofs* and *impure parts* by means of a *gradual Heat*, whereby there is a *white powder* called *Sublimate* made of *Calcanthum*, *Quick-silver*, *Vitriol* and *Sal Armoniack*, which is used as a strong *Corrosive* upon *Metals*, &c. *See* Calcination & Quickfilver,

SUDS, *See* Lees, Lixivium.

SULLAIN, *Stubborn*, that is, *Oars* or *Metals* that are not *easily melted* by *fire*, as the soft *flowing Metals* or *Oars* are.

SULPHUR, T. *Schweffel*, L. *Sulphur*, and *lapis ardens*; of which there are various *sorts*, both *natural* and *artificial*, and many delightful *Observations* may be made on them: *See* Brimstone & Bitumen.

SUN, T. *Sonnen*, L. *Sol*, from which *Celestial Heat* and also

also from the *Terrestrial Fires*, many *excellent* things are produced in *Metals*; viz. in making *Aurum Potabile*, as also a most *sovereign Water* from the *rayes* of the *Sun*, by *reflection* on *Gold*, which I may hereafter *communicate*.

TA T TI

TALCK, *l.* 1. *c.* 4. *s.* 2. T. A. *Talck*, L. *Talcum*, (by *Pliny*, *l.* 36. *c.* 22. called *Lapis specularis*, of which he gives a large Account. It is a *foreign stone* (for I do not hear of it in *English Mines*) of a *glassy transparent Nature*; resisting both *heat* and *cold*; the *red* is mentioned by *Erckern*, but the *white* more common.

TALLOW, *l.* 1. *c.* 17. *s.* 3. T. *Unschlet*, L. *Sevum* or *sebum*, A. *Suet* or *Tallow*, much used about *Metals*.

TARTAR, *See* Argol, Dregs, Feces.

TEST, *T.* *Schirbin*, *L.* *Proludium* (*Holiock*) but I had rather take it to be an abreviation of *Testis*, as a *Witness* of the goodness of *Metals*, by *trying* and proving them in little *vessels*, prepared by *Assayers* for that purpose: *See* Crucibles *and* Utensils.

THORNELS, *T.* *Deerleins*, fully explained by *Erckern* what they are, *L.* 3. *c.* 22. *s.* 3. In short, it is a term of *Art*, for that which remains of the *roasted Oar*, *unmelted*: *See* Keinstocks.

TILE, *l.* 2. *c.* 41. *s.* 1. *See* Brick, Earth, &c.

TIMODE, *l.* 2. *c.* 2. *s.* 8. *T.* a name for *Cloth* made of *Flax*, or *Hemp* or *Wooll*; and so in *A.* called *Linsy-woolsy*; which is used sometimes for *strainers* of *Metals*.

TIN, *l.* 3. *c.* 12. *s.* 6. *T.Zin.* L.*Stannum*, from whence we

[L l] have

have the word *Stanaries*; by which *Court* the *Tin-Mines* in *Cornwall* are governed: now this *English Tin* is esteemed to be the best in all other *parts* of the *World*; the *Spaniards* and *Italians* calls it *stagno de cornoij valla*: the *French de Corno Vall en Angliterre*. *See* Zwitter.

TIN-plates, are properly *Iron plates* covered with *Leaves* of *Tin*, and because of the outward *Colour*, call'd *Tin-Plates*.

TIN-sope, T. *Zinseife*. *See* Sope.

TONGS, TOUCH-needles, TOUCH-stones } *See* { *Utensils*. *Needles*. *Stones*.

TOWER, *Trayes*, *Trevet*. *See* Utensels.

TREMBLE, *l.* 2. *c.* 48. *T. Beben*, and *Zuttem*, *L. Tremere*: see *Boyling*, *Seething*, *Quivering*, &c. All *expressing* a *different* motion in *Metals*, whilst *Melting*.

TROY-*weight*, *See* Measures *and* Weights.

TUB, *l.* 1. *c.* 11. *s.* 5. *T. Fas*, *L. Vas*, *A. Vessel* or *Tub*; and are of various Forms used about *Metals*. *See* Utensils.

TUNNEL, *l.* 2. *c.* 16. *s.* 5. &c. *T. Ein Tunnen*, *L. Tinella*. *A.* do account it the same with *Tunnel* or *Funnel*, and yet the *T. L.* and *A.* have different words, *viz*. *T. Tas*, *Trehter*, and L. *Vas* and *Infundibulum*, *A. Tunnel* and *Funnel*. *See* Utensils.

TURF, *l.* 4. *c.* 9. *s.* 1. T. *Hin Grasz-buch*, *L. Cæspes*, *A. Sods*, *Turf*, *Peat*, which will admit further Discourses, *viz*. which of the three is best for *melting Metals*, when other Fuel is scarce: *See* Utensils.

TUTTEE. *l.* 2. *c.* 39. *s.* 2. *T. Tutian*, L. *Tutium*, *Pompholix* and *spodium* (which *Pliny* doth distinguish) but in *A.* they all go under the Name of *Tuttee*; which is nothing else but the the *volatile part* of *Brass*, when, in burning it *sticks* to the *upper part* of the *Furnace*, and the *common sort* of it is only *Calamine Stone* calcined, of great use for Medicines. *See* Calaminaris.

V

VA VI

VAPOUR, T. *Duust*, and *Dampff*, A. *Vapour*, which ariseth sometimes from *heat*, and sometimes from *cold causes*. *See* Evaporate, Quickſilver and Sublime.

VERNISH, *l.* 2. *c.* 29. *ſ.* 4. T. *Furnaeſs*, L. *Vernix*; a compounded *liquid ſubſtance* made with *Oyls* and *Gums*, to make *Metals* or *Metallick Utenſils* look *ſlick*, and reſemble *Glaſs*, in which the *Indians* do *excel*.

VEINE, *l.* 2. *c.* 12. *ſ.* 1. T. *Gengen*, L. *Vena*, A. *Veine*, which *Minſhaw* (I ſuppoſe for *ſound*-ſake) writes *vain*, ſo making our *veins* but the *efflux* of *vanities*, but thoſe who thought the *Terreſtial World* to be a great *Animal*, and that the *ebbing* and *flowing* of *Seas* are but the *ſyſtole* and *diaſtole* of its breath, might well believe that *Metals* and *Minerals* were the *Veins* of its *body*; but of the *nature* of *Metallick Veins*, *G. Agricola* gives the moſt exact *account*.

VENETIAN *Glaſs*, *l.* 2. *c.* 16. *ſ.* 5. T. *Venidiſchem-glaſsz*. L. *Vitrum Venetianum*, from the City *Venice*, where *Erckern* ſpeaks that the beſt *Glaſſes* for *Metallick* uſe are made, and probably ſo in his time; but now that *Art* in *Venice* is thought to be *equall'd* in *England*: *See* Glaſs.

VERDIGREASE, *l.* 2. *c.* 27. *ſ.* 1. T. *Gruen-ſpan*, A. *Spaniſh green*, L. *Ærugo*, or the *Ruſt* of *Copper*, by hanging *plates* of it over the *fumes* of *Wine*, from whence a *Crocus* will ariſe, which we call *Verdigreaſe*; *See* Braſs, Copper, and in *Colours*, Blew, Green.

VIAL or *Glaſs Bottle*, *l.* 2. *c.* 30. *ſ.* 1. T. *Roelblein-Fiale*, and *Angſter*, according to the proportions, L. *Phiala* and *Ampulla*,

pulla, A. *Vial*, to diſtinguiſh it from the Muſical *Inſtrument* call'd *Violl*.

VINEGAR, *l.* 1. *c.* 33. *ſ.* 1. T. *Eſſig*, L. *Acetum*, A. *Vinegar*, now the various ways of making and uſing it, in *Metallick experiments*, may deſerve a large *Diſcourſe*, as being one of the great *ſecrets* of *Nature*.

VITRIOL, *l.* 2. *c.* 33, &c. T. *Schuſter-ſchwacitz*, L. *Vitriolum* and *Calcanthum* (which latter makes a black colour.) Now of *Vitriol* there are many natural ſorts; but the three chief are 1. of a *Saphire colour*, (which comes from *Hungary* and *Cyprus*:) 2. of an *Emeral* or *green colour* (from *Swethland* and *Goſlar*,) often mentioned by *Erckern*; 3. a *white* (from *Denmark*, &c.) there is alſo an *Artificial Vitriol*, made from *Copper* or *Iron*, or both, which is called *Roman Vitriol*, or *Lapis Cœleſtis*, from its tranſcendent vertues, of which (beſides what Sir *Kenelm Digby* writes; I could add many from my own experiments, but muſt refer them alſo to my intended *Eſſays* on *Agricola*; *See* Braſs, Copper, *and in Colours*, Black.

ULTRAMARINE, which the *Italians* call *Azuro ultramarino*, and is a *Gem* found in *Mines*, ſometimes called *Lapis Luzuli* (often mentioned by *Erckern*, *l.* 1. *c.* 2. *ſ.* 11, *&c.*) and is of a *pure blew*, and of which (either conſidered as a *Gem*, *Oar* or *Stone*) the *Italians* do make a pretious *Blew* for *Painters*, ſold beyond the *price* of *Gold*.

VOLATILE, *l.* 1. *c.* 10. *ſ.* 9. T. *Flutch-tigon*, L. *Volatilis* (which ſignifies a Bird, *Holiock*) according to *Paracelſus* it is uſed for any light matter, either aſcending from *Metals*, or other light *ſubſtances*. See Quickſilver.

UPBUCKING, *l.* 4. *c.* 14. ſignifies ſome extraordinary *waſhings* of *Metals*, and ſo the word *upboyling*, is more than ordinary *boyling*.

URINE, *l.* 2. *c.* 8. *ſ.* 2, &c. T, *Dertlarne* and *Bruntz*, L. *Urina*, from *Uro*, becauſe it is of a *ſcalding* and *burning nature*, of great uſe about *Metals*, it is *diſtill'd* and *extracted*, by a *natural heat* and *internal Furnace* in all *Creatures*, by which *na-*

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tural extraction, we learn the method of all *salous productions*. *See* Salt, &c.

UTENSILS, *T.Brauchers*, L. *Utensillia*, A. *Instruments*, useful *tools*, or *houshold* necessaries; but I must refer those which are mentioned by *Erckern*, to the Contents of the *Sculptures*, placed immediately before his first Book,) where you will find most of them recited, and referr'd to their pages, as also in the second part to their Capitals; only there is an *omission* of the T. and L. words for them, which will be rendred in *Agricola*.

WA WA

WARDENS, *l.*1. *c.*1. T. *Gwardeins*, L. *Guardianus*, A. *Guardian* and *Warden*; I intended an addition herein, to shew that the *Original* of this word, as to an *Official duty*, was first given to the *Warden* of *Mines*, and that all other *Offices* which bear the *Title* of *Wardens*, were *derivatives* from thence, *viz.* of the *Mines*, *Mint*, *Stanneries*, *Church*, *Ports*, *Fleet*, *Colledges* and *Companies*, which I shall hereafter inlarge and place according to their Antiquities.

WARM, T. *Warme* and *waerm*, L. *calidus*, A. *warm*, that is to bring *Metals* into a *moderate warmth* or *heat*.

WARTZ, *l.* 1. *c.*35. T. *Wartz*, A. *the Pin of the Beam*, and these are little pieces of *Iron* (like *Excrescencies*) *filed* out of the *Centre* of the *Ballance* on each side of it, which are *fitted* for the two little *holes* of the *Fork*, whereby the *Ballance* is made *capable* to *move*, and from hence our *English* word *Warts*, for *excrescencies* on the *hands*, or other parts, is used.

WASHING, *l.*3. *c.* 2, &c. T. *washein*, L. *Lavare*, A. *La-*

vation, and *Washings*; Now you may have a full account of the *manner* of *washing Metals* in *N.N.* before recited.

WASTE, T. *Vermuesten*, L. *Vastare*, A. to waste, consume or lessen the bulk of *Metals*.

WATER, T. *Wasser*, L. *Aqua*, *ex qua omnia* (as *Scaliger* and other more antient *Philosophers* define it.) See *Erckern* in many parts; and this *subject* of *Waters* might *afford* many *pleasing Discourses* of ours in *England*, and of such also as are of great *natural uses* in *Metallick Operations* besides *Artificial*, yielding *curious varieties*, especially from some *Waters* in those *Countreys* which do not consist of *Mines*, where the waters only by heat of the *Sun*, without their *fire*, do yield a *perfect sediment* of *Gold Sands*.

WAVER, T. *Schwenneken*, L. *vagilare*, A. to wag to and fro: *See* Trembling.

WAX, T. *Wachz*, L. *Cera*, A. *Wax*. *See* Cement and Glutination.

WEATHER, *l*. 1. *c*. 34. *f*. 8. T. *Wetter*, L. *Æther*, this hath great *operation* in *Metals*, for as the *Weather*, so *Metals* are *hard* or more *ductile*, &c.

WEIGHT, *l*. 1. *c*. 36, *&c*. on which subject I did intend to enlarge; *See* Measures, *and* Agricola de mensuris.

WELL, T. *Brun*, L. *Puteus*, A. *Wells*, for *Springs* of *Water*, and called *Shafts* for *Metallick Wells*; *See* Mines.

WHEEL for *waters*, *l*. 4. *c*. 8. T. *Wasser-Radst*, L. *Haustrum*, used for the raising of *Waters* out of *Springs* or *Wells*, with which the *Miners wash* and *purge* the *Oars* from the *earth* or *rubbish*, and then the *Miners* may say *well*, the *Oars* are *well wash't* with *Well-water*, but of the description of the *several sorts* of *Wheels* you will see more in *Agricola*

WHETSTONE, l. 1. *c* 34. *f*. 9. T. *Wetzsteine*, L. *Cos*, which is used to *Metallick Instruments*, and to *rub Metals*.

WHITE, T. *Wize* and *blank*, L. *Albus*. *See in Colours*, White.

WINE, T. *weine*, L. *Vinum*, of various sorts and uses in *Erckern*. See *Pliny*.

WINE-

WINE-ſtone, *See* Argol, Tartar.

WOOD, T. *Wald* and *Haltz*. L. *Lignum*, A. *Wood*, of ſeveral ſorts for *Metals*, *See* Charcoal Coals.

WOOL, T. *Wolt*, L. *Lana*, uſed about *Metals*.

WRINCLE, T. *Runtzel*, L. *Ruga*, that is, *Metal* not *polite*, but *ſhriveled*, *diſtorted*, and full of *contracted parts*, unuſual to its natural *ſmoothneſs*, as in *hands*, *faces*, &c.

WYRE, T. *Kufforn dratt*, or *Copper drawn*, L. *Aurum netum*, i. e. *Gold Wire*, or *Gold* drawn or ſpun out of *Gold*; and *Filum Auricalcum*, or a kind of *Thread drawn* from *Copper*. A. *Wyre*, but I find no *Monoſyllable* for it in any other *Language*.

XA X XE

XANTHUS, a pretious ſtone, which *Pliny l.* 37. calls alſo *Henui*, of great *virtue* to give ſucceſs in *Mens* Imployments, and conſequently to *Metallick* Works; *Erckern* doth not mention this, but ſpeaks of *Hazel*-Nuts, from which Plant, the *Virgula Divina* (or *Divine Rod*) is made, by which *Mines* of *Gold* and *Silver* are diſcovered; and one of theſe I have out of *Germany*, but I cannot yet promiſe any *effects* by it: *See* Georgius Agricola, *and my* Notes *on him*.

XEROCOLLYRIUM, which is an *unguent* made of *Copper*, or *Copper* and *Lapis Calaminaris* mixt, to apply to ſuch *Eyes* as are prejudiced by *Metallick Operations*, and this is help'd alſo by *Tuttee*, waſh'd in *water*, then made into *powder*, and ſo into an *Oyntment*, which is commonly called *Unguentum Tutium* or *Oyl of Tuttee*.

XIPHON,

XIPHION or *Phasgenion*, *Pliny l.* 25. the root of which Plant *stampt* and *mixt* with *Wine* and *Frankincense* of *equal Proportions*, takes off all excrescent *Scales* from *Bones*, and may have the like *effect* upon the scales of *Metals*.

Y A Y E

YARD, *See* Measures.

YELLOW, T. *Galb* and *Geilb*. *See* in Colours, Yellow.

YEST, T. *Yest*, (but *Erckern* calls it *Hafin*, *l.* 2. *c.* 1. *s.* 3.) A. *Test*, also *Barm*, *God's-good*, *Rising*, *Beer-good*, *Foam*, *Froth*: the *Latines* calls it *Spuma*: and the *froth*, *flores Cervisiæ*, or the *Flower* of *Ale* or *Beer*, and *Cervisiæ* they derive from *Ceres*, the Goddess of *Corn*, who first taught the sowing of *Wheat* and *Barly*, and of *Drinks* from thence: so that in *Norfolk* where it is called *Gods-good* it may well be alluded to the *spirit* of that *Goddess's Good* which she infused into it, as a firmentation: but more properly to be attributed to *God* himself, for communicating so great a *Secret* for the *Benefit* of *Mankind*: for without *Fermentation* scarce any useful thing is perfectly attained unto, and that Motion doth *operate* not only in the *terrestrial Orb*, both by *Sea* and *Land*, but on the *Elements* and *celestial Orbs*. *See* Litarge.

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ZUITTER, *l.* 4. *c.* 11, 12, and 13. explaind to be *Tin* well beaten, and 'tis not only thus with *Metals* which muſt be *beaten*, (that the Advantages may redound to themſelves in a more refined *temper*, and make them uſeful to the World) but we ſee that Corn muſt be *thraſh'd*, and ground for *food*: *Grapes* and other *fruits* contuſed to make Liquors more acceptable, and man himſelf muſt undergo *Oppreſſions* to make him happy, which I here mention as my Concluſion, in Imitation of *Erckern* his Zeal for *God's* Glory, wherewith he concludes the laſt page of his five Books; for according to the Maxim of the *Roſy Crucians* (and beſt *Chimiſts*) *Excellentiſſima dona abſque Pietate vana*: which may be rendred thus, *By true Piety the braveſt Sciences are accompliſhed.*

FINIS.